THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The prospect of a conflict between blast furnace operators in the Mahoning and Shenango valleys and their employees may become a factor of some importance in the situation. The furnacemen recently decided on a reduction from $1.90 to $1.65 for turn work and the employees at a delegate convention this week not only decided to strike in case the reduction is put in force, but presented a counter demand for a 10 per cent increase. The indications are that operations will sto pat all the valley furnaces now in blast these including a number of important plants connected with steel works. Should such a deadlock be prolonged the effect would be felt throughout the Central Western market. A number of the merchant furnaces are now idle, with no immediate necessity for starting up; in these cases the employees have certainly chosen the wrong time for making the issue. Unless wages can be brought in line with the price of iron these furnaces will plan for a long idleness. In the past week there have been considerable sales of Bessemer iron, prices ranging from $13.25 to $13.40 at Pittsburg, and when the deliveries are made in the next two months stocks in the valleys will be very materially reduced. However, the large steel companies will be more and more independent of merchant supply as the year advances. There is no general buying movement in foundry iron as yet, though it is understood that agricultural and malleable interests have yet to make considerable purchases. Prices have been stationary in most markets, with some tendency to concessions where large orders are involved. Consumption is heavier than at any time since early in 1900, but production is increasing steadily and consumers have been counting on lower prices after ore shipments begin for the new season. The effect of such a strike as that impending in the two valleys is of course not allowed for in such reckoning. So far as the prospects for the year can be judged thus early, there are preparations in many directions for an extraordinary use of iron and steel. Building projects in architects' hands are numerous and in all the large cities plans are made for the pushing of much work that was held up by strikes and high prices last year. Money to carry out all such projects is abundant. The rail mills have booked a fair amount of business since the year opened, electric lines in the Central West contributing some good orders. In the Chicago district a 20,000-ton contract for export was booked in the week. The announcement that prices on rails would be withdrawn on Jan. 15 may have hastened some buying, but there is still skepticism concerning the reported purpose of the pool to make a $2 advance with Feb. 1. Mills in all districts are fully occupied and none are pushing for business. Meantime finished material markets are rather dull, particularly in bars, buyers having so fully provided for their wants. The announcement of the Carnegie Co.'s plans for tube mills at Conneaut, O., while at first received with some incredulity, is now generally accepted, and in its wake has come a variety of reports, some unsettling while others point to plans for preventing destructive competition by an extensive application of the community-of-interest principle to the steel trade.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Jan. 16.

As a result of lower prices abroad the falling off in the foreign business of the iron and steel manufacturers of the Pittsburg district has been pronounced in the past month. Since the opening of the year prices have gone still lower in England, Scotland and Wales with the result that Pittsburg producers in order to compete will be compelled to sell their products below cost. The high freight rates are now more of a factor than ever before and the prevailing rates to the seaboard by rail are militating against the producers as they never did before. The past week has seen a reduction in the tariffs on iron and steel products from this district, but a close analysis of the reduction shows that it is not as great as it was believed to be when it was first announced. The railroads did not meet the demands of the iron and steel shippers who asked for as low rates as were made from any other districts and in addition failed to make a special export rate to the seaboard. If such a rate were in existence at the present time it would greatly aid local manufacturers in competing against the low prices abroad, but since the high domestic rates must be paid much of the foreign trade secured after a large expenditure is gradually being lost.

The finished steel market during the past week has been quiet, although sufficient new business was placed by small consumers to show that they have faith in the conditions and are not waiting as was the case at this time last year. The sales of Bessemer iron during the week were greater than they have been within the previous month and somewhat higher prices were realized than on iron sold only ten days ago. In foundry and forge there were small sales aggregating about 5,000 tons of the former and about 4,000 tons of the latter. The blast furnace situation in the valleys is beginning to assume a threatening stage as the furnace laborers whose wages are to be cut on Feb. 1 have decided to go on a strike if this reduction is carried out. On Thursday a meeting will be held at Sharon, Pa., of the furnace interests in the Shenango valley for the purpose of considering the advisability of placing the furnace carriers in that section on a day basis instead of on a tonnage basis as they are paid at the present time. It is also asserted that any attempt to carry out this policy will result in a strike. Everything considered the blast furnace situation in the valleys is not as bright as the operators would like to have it, from a labor standpoint. It is claimed that the sales of Besemer iron during the week were sufficiently large to practically clean up the accumulated stocks at the valley furnaces. If this is the case any considerable buying movement will result in the resumption of some of these furnaces the majority of which have been out of blast since September last.

PIG IRON.—Sales of Bessemer iron during the past week were greater than for the preceding month and while small lots aggregating about 10,000 tons were sold it is stated that one large lot was sold to a Pittsburg consumer that will practically clean up the accumulated stocks at the merchant furnaces in the valleys. This iron is for delivery during the months of February and March and was sold at prices ranging from $13.25 to $13.40, Pittsburg. With the cleaning up of these stocks there is little doubt that there will be a resumption of some of the furnaces if any kind of a demand sets in. In foundry iron prices are ruling somewhat lower although the sales of the past week were not at all discouraging, amounting in all to about 5,000 tons. Large lots of foundry No. 2 were sold at $13.75 per ton, delivered Pittsburg, while small lots

brought $14. The sales of forge iron aggregated approximately 4,000 tons. A few sales were made at $13.10, while the majority of the iron was placed at $13.25 to $13.40. Beginning with Feb. 1 the freight tariffs between the valley furnaces and Pittsburg will be reduced from 90 cents to 75 cents. We revise our quotations as follows:

Bessemer, Pittsburg	$13.25 to $13.40
No. 1 Foundry	14.50 to 15.00
No. 2 Foundry	13.75 to 14.25
No. 3 Foundry	13.50 to 14.00
Gray Forge, Pittsburg	13.10 to 13.40

STEEL.—We note the sales of small lots of billets during the past week, amounting all told to about 5,000 tons. In every instance the agreed price was paid. A number of consumers have already inquired whether the reduction in the tariff rates to various points will not result in a somewhat lower price to various delivered points on billets, sheet and tin bars. No change in the present schedule will be made. The manufacturers claim that in nearly all instances a great portion of the tariff rates have been absorbed by the prices made and that they should benefit by the lower tariffs. We make the following quotations: 4x4 billets, delivered, Pittsburg, Wheeling or Valley at $19.75. On less than 4-inch billets down to 1½-inch $1 extra is charged. Open-hearth billets are $1 per ton above Bessemer billets at all delivered points. Sheet and tin bars are $1 above Bessemer billets.

RAILS AND TRACK MATERIAL.—During the past week several orders for standard section rails, including one for 10,000 tons, were received by the Carnegie Steel Co., but so far as large contracts are concerned the few still unplaced are still hanging fire. Specifications on contracts closed are being received daily and the Edgar Thomson mill is being operated at its fullest capacity. Although no further advances have been made in light rails the demand continues strong. The demand for track material is fair. Our quotations unchanged are as follows: Rails, standard sections, 50 pounds and over, in lots of 200 tons and over, $26; car lots and less than 200 tons, $28; less than car lots, $30; 16 to 20 pounds, $29; 25 to 40 pounds, $28. Track material: Spikes, 1.70c to 1.75c; track bolts, square heads, 2.25c; hexagon heads, 2.35c; fish plates, 1.40c to 1.50c.

FERRO-MANGANESE.—The largest producer continues to quote $62.50 per ton for domestic 80 per cent in car load lots, delivered at buyer's mill.

SPELTER.—We hve been advised of the sale of 100 tons of spelter to a Pittsburg consumer during the past week. The market is ruling low and quiet and prime western grades are held at 4.07½c to 4.10c. Pittsburg.

MUCK BARS.—There is little doing in muck iron small sales having been made at $25 per ton delivered, Pittsburg.

SKELP.—The skelp market is ruling very quiet. Iron skelp, both grooved and sheared, is held at 1.50c to 1.55c, while steel skelp is held at 1.35c.

BARS.—Small business in steel bars continues to be placed and local mills are kept in full operation not only on this new business but on specifications received on contracts placed during the past summer. Prices are firm, small business commanding from 1.30c to 1.35c. More than car lot orders can be placed at 1.25c. Common iron bars are held at 1.35c delivered, Pittsburg, and refined iron bars at 1.75c.

PLATES.—Considerable small business was placed in plates during the past week. Mills continue in full operation and it is next to impossible to secure delivery within less than two or three months. There has been considerable business since the first of the year in fire-box steel, the locomotive builders buying heavily. The next meeting of the plate manufacturers is to be held early in February and it is not at all improbable that the price will then be advanced. Prices are unchanged as follows: Tank plate, ¼-inch thick, up to 100 inches in width, 1.40c at mill, Pittsburg; flange and boiler steel, 1.50c; marine, ordinary firebox, A. B. M. A. specifications, 1.60c; still bottom steel, 1.70c; locomotive firebox, not less than 1.90c, and it ranges in price to 3c. Plates more than 100 inches wide, 5 cents extra 100 pounds. Plates 3-16 of an inch in thickness, $1 extra; gauges Nos. 8 and 9, $2 extra. These quotations are based on carload lots, with 5 cents extra a hundred pounds for less than carload lots. Terms, net cash in 30 days.

SHEETS.—A number of large producers now refuse to make further contracts for delivery during the first half of the year and are only quoting for delivery in the first four months. Prices are unchanged but firm. The new sheet mills which Zug & Co. have under construction will be ready for operation by the middle of April or the early part of May. We quote as follows: Black sheets, No. 28 gauge, one pass through cold rolls, 2.95c to 3c; No. 27, 2.85c to 2.90c; No. 26, 2.70c; No. 24, 2.60c; No. 22, 2.50c; No. 20, 2.40c; No. 18, blue annealed, 2.15c to 2.20c; No. 14, 1.90c to 2c; Nos. 11 and 12, 1.75c to 1.85c; No. 10, 1.65c to 1.70c; plates, gauges 8 and 9, 1.55c to 1.60c. Galvanized sheets continue to be held at 75 off with no freight allowance.

STRUCTURAL MATERIAL.—Although no official announcement has yet been made it is reported that the American Bridge Co. has secured the contract for the erection of the Fort Wayne bridge across the Allegheny river. It will require about 10,000 tons of material, the shapes for which will undoubtedly be rolled by the Carnegie Steel Co. We make the following quotations: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.50c; angles, from 3 to 6 inches, 1.40c; universal mill plates, 1.40c.

PIPES AND TUBES.—A fair amount of business is being placed considering the time of the year. Prices remain unchanged. Discounts to consumers in carload lots, Pittsburg, are as follows:

MERCHANT PIPE.

	Black, per cent.	Gal'vd, per cent.
⅛ to ⅜ inch and 11 to 12 inch	61	48
½ to 10 inch	68½	56

BOILER TUBES.

	22 Feet and under. Per cent.		Over 22 Feet. Per cent.	
	Iron.	Steel.	Iron.	Steel.
1 to 1¾ and 2¼ to 5 inches, inclusive	49½	68⅓	44½	65
2 to 2¼ inches, inclusive	45	61	39½	59
6 inches and larger	57	62	52⅓	58

CASING.

	S. and S., per cent.
2 to 3 inches	58
3½ to 4 inches	63
4½ to 12½ inches	65

O. D. PIPE.

	Per cent.
14 to 22 inches	42
24 inches, o. d. and larger	37

THREADS AND COUPLINGS.

	Per cent.
14 to 16 inches, o. d.	35

MERCHANT STEEL.—During the past week the price of horseshoes has been advanced; to jobbers the new prices are $3.25 for steel shoes and $3.50 for iron shoes. The demand for shafting is excellent, but prices are unchanged. We quote as follows: Shafting, carload lots, 55 per cent off, less than car lots, 50 off; tire steel in carload lots and over, 1.40c; less than carload lots, 1.45c to 1.50c. Toe calk is held at 1.50c to 1.55c in large lots, and in small lots as high as 1.60c. Tool steel is held at 7c and upwards according to quality. Hoops and bands, 2c to 2.10c.

OLD MATERIAL.—Iron rails continue a very scarce article and we note the sale of a small lot during the week at $22 per ton. Otherwise the market is featureless. We revise our quotations as follows: No. 1 railroad wrought, $18; car wheels, $18; new Bessemer melting stock, $14; iron rails, $21 to $22; steel rails, mill lengths, $14.50; busheling scrap, $14.50; borings, $6.75; turnings, $9.

COKE.—An attempt is now being made to form a gentlemen's agreement among the manufacturers of coke. It is to include the producers both in and outside of the Connellsville region. Prices have gone so low that producers no longer consider the competition altogether healthful to their business. Some of the largest producers favor the agreement. They argue that the manufacturers of iron and steel products are able to secure uniform and better prices by agreements and they see no reason why they cannot do likewise. The movement, however, is yet in its infancy. While the largest producer is holding furnace coke at the ovens in the Connellsville district at $1.75 per ton lower prices are being made by other producers in the district. Foundry coke while being quoted at $2.25 is being sold according to reports at lower prices. From Chicago comes the report that fierce competition has resulted in extremely low prices, although the market at Cleveland and in the valleys is in much better condition. In the east furnacemen who have not yet placed their business are asking quotations for three months only, believing that lower prices will be made at the expiration of that time.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1522 MONADNOCK BLOCK, Jan. 15

There has been considerable activity in some branches of the market, and the prospects for a still further increase in business in the near future are excellent. Buying has not yet been especially heavy but consumers generally are expected to come into the market within the next few weeks, and it is thought a heavy tonnage will be placed within that time. Many of the buyers will have to add to the purchases made earlier in the season, which at that time were thought sufficient to run them through. This is especially true of the implement makers and the malleable foundries.

PIG IRON.—Two or three good sized contracts were placed last week, including one for several thousand tons given by an implement maker, and divided among several furnaces, both Northern and Southern. This sale was made at something under the open quotations, but generally speaking the market is unchanged and most of the furnaces are selling on the basis we quote. A number of buyers are in the market who are expected to place their business immediately, and the outlook for the next week or ten days is better than for several weeks past. A reduction in freight rates from the Southern furnaces is announced to take effect Feb. 1, but the exact amount is not as yet known. It will probably be 20 cents a ton, and sellers are figuring on this. This will make the rate $3.65 to Chicago from Birmingham. The Calumet furnace at South Chicago went into blast this week. Our quotations as given below are revised somewhat to represent more nearly the present actual conditions, the minimum figure on some local irons being put at 25 cents below our last quotation:

Lake Sup. Charcoal	$18 50 to $19 00	Southern Coke No. 4	$13 60 to $14 10
Local Coke Fdy. No. 1	15 50 to 16 00	Southern No. 1 Soft	14 10 to 15 60
Local Coke Fdy. No. 2	14 50 to 15 00	Southern No. 2 Soft	14 60 to 15 10
Local Coke Fdy. No. 3	14 00 to 14 50	Southern Silveries	15 50 to 16 00
Local Scotch Fdy. No. 1	15 50 to 16 00	Jackson Co. Silveries	17 00 to 18 00
Local Scotch Fdy. No. 2	14 50 to 15 00	Ohio Strong Softeners	15 75 to 16 25
Local Scotch Fdy. No. 3	14 00 to 14 50	Alabama Car Wheel	21 00 to 22 00
Southern Coke No. 1	15 10 to 15 60	Malleable Bessemer	15 00 to 15 50
Southern Coke No. 2	14 60 to 15 10	Coke Bessemer	15 00 to 15 50
Southern Coke No. 3	14 10 to 14 60		

BARS.—The steel bar makers are very full of business, and are not going after it at all. They have orders on their books for about all they can make for several months, and have refused business in the past two or three weeks. Iron mills are hardly in as good condition, but have a good tonnage booked, and are very firm. The demand for both steel and iron is large, and good sales are being made every day. The market is firm and unchanged at 1.45c to 1.50c, half extras, Chicago, for both iron and steel.

STRUCTURAL MATERIAL.—The week has been quiet, with no large contracts placed, but several new projects have come up and will probably be placed in the immediate future. These involve several thousand tons and include office buildings and other structures. Bridge building is good, and the bridge contractors are using large quantities of material. Quotations are unchanged as follows: Beams 15 inches and under, 1.65c; 18 inches and over, 1.75c; angles under three inches, 1.40c to 1.45c; over six inches, 1.65c; three inches to six inches, 1.55c; plates, 1.55c; tees, 1.70c; zees, 1.65c; small lots from store are quoted ⅛c to ¼c higher.

RAILS AND TRACK SUPPLIES.—Sales for the week aggregate about 30,000 tons of standard sections by the local mills, including an export order for 20,000 tons, besides a good tonnage of light rails and track fastenings. A number of good orders for standard sections are in prospect, and will be placed soon. Quotations are as follows: Rails, standard sections, $26; light sections, $26 to $28; splice bars, 1.40c to 1.50c; spikes, 1.70c to 1.75c; track bolts, hexagon nuts, 2.55c to 2.60c; square nuts, 2.40c to 2.50c.

PLATES.—A contract for 6,500 tons of plates was taken by the local mill in the week, besides a considerable tonnage of small lots. The demand is large, and seems likely to continue so. Prices are made as follows, mill shipment, Chicago delivery: Tank steel, 1.55c; flange steel, 1.65c; marine steel, 1.75c; fire-box steel, ordinary, 1.75c; firebox, special, 2.25c and upwards.

BILLETS AND RODS.—No sales of either billets or rods are reported. Bessemer billets are unchanged at $20.75, Chicago.

CAR MATERIAL.—The demand continues large, and good sales of all kinds of material entering into car construction were made last week. The car works are very full of orders.

SHEETS.—Sales in the week were large both by jobbers and consumers, and seem likely to continue so, as a number of large inquiries are still in hand unsatisfied. Quotations are very firm and unchanged at 3.18c for No. 27 black, and 70 and 10 per cent off for galvanized mill shipment.

MERCHANT STEEL.—The market has been quiet, with no very large tonnage closed last week. Mills are very busy filling old orders. Quotations are as follows, mill shipments, Chicago delivery: Smooth-finished tire steel 1.75c to 1.85c; open-hearth spring steel, 2.15c to 2.35c; toe calk, 2.40c to 2.55c; sleigh shoe, 1.70c to 1.80c; cutter shoe, 2.40c to 2.55c; ordinary tool steel, 6c to 7c; specials, 13c and upwards.

MERCHANT PIPE.—The demand is good for small lots, and two or three quite good sized orders were taken last week. There is a good prospect for a heavy business in the future. Random lengths, Chicago delivery, are quoted as follows:

MERCHANT PIPE.

	Carload lots.		Less than carload lots	
	Black	Galv.	Black	Galv.
	Per cent.	Per cent.	Per cent.	Per cent.
⅛ to ½ and 11 to 12 in	59.3	46.3	54.9	40.9
¾ to 10 inches	66.7	53.3	61.9	49.9

WIRE AND WIRE NAILS.—Sales continue very large, the tonnage for last week having been exceptionally heavy for the season. The demand indicates good business for an indefinite time. Makers quote single carloads of wire nails at $2.48 f. o. b. Chicago, and $2.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $2.43; painted barb wire $2.78; galvanized barb wire, $3.08.

OLD MATERIAL.—The market has been more active than for several weeks past. Several of the large railroad systems had large offerings of old material of various kinds which were all absorbed last week, aggregating about 7,000 tons. Very good prices were obtained for all of it. The dealers did a fair business with consumers, and at the beginning of the present week the demand showed a very considerable increase, several good sales being closed Monday, including two of 1,000 tons each. The Republic Iron & Steel Co. has been in the market, but has been buying to some extent outside of the city. The market is very firm, but is practically unchanged from a week ago. The following are dealers' selling prices, per gross ton:

Old iron rails	$18 50 to $19 00	Old wheels	16 00 to 17 00
Old steel rails, long	15 00	Heavy melting steel	10 50 to 11 00
Old steel rails, mixed	11 00 to 12 00	Mixed country steel	9 50 to 10 00
Relaying rails	20 00 to 22 00		

The following prices are net ton:

Railroad forge	14 55 to 15 00	Cast borings	3 00 to 3 50
Dealer's forge	12 50 to 13 00	Wrought turnings	7 85 to 7 90
No. 1 cut mill	9 75 to 10 00	Iron axle turnings	9 50 to 10 00
Heavy cast	11 50 to 12 00	Steel axle turnings	8 00 to 8 50
Railway malleable	11 50 to 12 00	Stove plates	8 50 to 9 00
Country malleable	9 75 to 10 00	Old iron splice bars	16 50 to 17 50
Iron axles	18 00 to 19 00		

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
CAXTON BUILDING, Jan. 16

PIG IRON.—There is nothing yet that may be called a buying movement, though some orders are being placed each week. The statement of reduced stocks in December in the face of a heavy increase in production is considered encouraging to producers; but the January resumption by stacks idle for some time means a considerable further increase in make. Prices are stationary—the average furnace still getting $13.50 for No. 2 foundry iron, though 25 cents below this and it is believed somewhat lower, has been done. The average current business is in 100-ton lots. Consumers seem to have expectations of lower figures when the ore price is made; but furnacemen argue that they will need the reduction that may come in ore to give them the profit that it is difficult to find under today's conditions. With Feb. 1 the reduction in wages at valley furnaces and the 15-cent reduction in freight to Pittsburg and Cleveland goes into effect. We quote basic iron at $13 to $13.50 at valley furnace and gray forge at $12.50 to $12.75. Bessemer stocks are being lowered slowly but owners of idle merchant furnaces find no reason as yet for starting them up. Quotations are as follows:

Bessemer	$14 00 to $14 25	Valley Scotch No. 1	$14 75 to $15 00
No. 1 Strong F'dry	14 75 to 15 00	Valley Scotch No. 2	14 25 to 14 50
No. 1 Strong F'dry	14 00 to 14 50	Gray forge valley	12 50 to 12 75
No. 3 Foundry	13 50 to 14 00	Lake Superior charcl	18 00 to 18 50

FINISHED MATERIAL.—The first two weeks of the year have brought little business worthy of note to local offices, apart

from rail buying. Electric railroad construction, in new lines and extensions, promises a busy season in 1901. In the past week 10,000 tons of rails were bought for Everett-Moore enterprises, and 5,000 tons for a road running from Toledo into Michigan. For the Findlay, O., electric road a 1,000-ton purchase is pending. The Everett interests, with the 10,000 tons of last week, have taken in all 25,000 tons of rails for 1901 delivery. Building projects in Cleveland are likely to take more steel the coming spring than has yet been counted on, architects' offices being unusually full of work. Some contracts for structural material have been placed this month by concerns buying 500 tons at a time. The bar trade is dull, the important consumers having contracted for months ahead. Steel bars are quoted 1.30c to 1.35c at mill by some Pittsburg mills that are filled up. Valley sellers quote 1.25c at mill. Bar iron continues quiet at 1.25c to 1.30c valley mill. It is reported that one large interest is adding to its capacity for bars at Youngstown and another is preparing to roll hoops, each making extensions in what is considered the principal line of the other. The sheet market is firm and there is a fair demand. Prices to the average small order trade range from 1.75c at mill for No. 10 and 1.85c at mill for No. 10 common blue annealed, or 2.20c at mill for Nos. 10 and 12, one pass through cold rolls, to 3c for No. 28, cold rolled. The plate trade is quiet. More vessels are talked of and more would be placed but for the fact that lake yards are filled for months ahead.

CINCINNATI.

Jan. 15.

Matthew Addy & Co. review the situation as follows: "The principal feature of today's market is the number of large inquiries on which sellers are figuring. These inquiries are not confined to any one branch of trade or to any one section of the country, and they call for all kinds of iron. The most notable inquiries, however, are from the agricultural implement makers. The actual business of the week has been very satisfactory, having been made up of many small transactions whose aggregate has been considerable. This business has been wonderfully well scattered. As we get further along into the season it is evident that consumers have very little iron on hand; in fact, their stocks are of the most insignificant kind, and the great majority of them will be forced to buy again within the next sixty days. In the South there is quite a shortage of soft irons, and these grades are in particular demand. The request to hurry shipments on current orders is as pressing as ever."

The following is from the weekly letter of Rogers, Brown & Co.: "The past week has fulfilled the reasonable expectations of those who did not anticipate the beginning of the buying movement until later in the month. A few good sized contracts have been placed, but most of the orders have come in for small lots for quick delivery. Nearly all reports received from consuming districts indicate that consumption is gradually increasing, and prospects of business for the current year are first-class, but in a few instances it has been said that works are shut down or are running with less than usual force. The malleable companies seem to be full of orders, but they are using up iron bought heretofore and have not been in the market to any extent of late. The cast iron pipe business is apparently improving, although prices are not satisfactory. The preliminary reports show that during December production was increased to a considerable extent, but furnace stocks have gone off slightly. The determination of prices of lake ores for next season's delivery will probably exert a decided influence on pig iron consumers. Many are waiting to see what the ore men will do. It must be remembered that Northern malleable and Bessemer iron are now being sold at less than cost of production, and if the price of Bessemer ore is dropped, it will not be possible for makers of Bessemer pig to reduce prices correspondingly and operate at a profit. They are now discounting the prospective decline in ores. This holds true to a large extent also regarding foundry irons made with lake ores."

We quote for cash f. o. b. cars Cincinnati: Southern coke, No. 1 foundry, $14.25 to $14.50; No. 2 foundry, $13.50 to $13.75; No. 3 foundry, $13 to $13.25; No. 4 foundry, $12.50 to $13; gray forge, $12.25 to $12.50; No. 1 soft, $14.25 to $14.50; No. 2 soft, $13.50 to $13.75; Lake Superior coke, No. 1, $15.50 to $16; No. 2, $14.50 to $15; Hanging Rock charcoal, No. 1, $20 to $21; Jackson Co. silvery, No. 1, $17 to $17.50; Standard Georgia car wheel, $18.75 to $19.75; Lake Superior charcoal, $19 to $20.50.

PHILADELPHIA.

Jan. 15.

The situation has not changed materially. Demand and supply are still the important matters at issue, and no safe prophecies can be made regarding them. The December output showed an increase at the rate of 1,000,000 tons per annum, which was largely offset by the large deliveries made. The output is still increasing, and it is a question whether the supply will not outstrip the demand, and result in a weakening of prices. Too much stress cannot be laid upon the fact that economic conditions are ruling the market, rather than any dictum as to prices. The export business is almost entirely in abeyance because of the decline of prices abroad. However, the largest producers are preparing to enter actively the foreign field, and will be aided extensively therein by the lower cost of production in this country. The billet market is quiet, while an increased activity in rails has been apparent owing to the announcement that the present price would be withdrawn this week, about 200,000 tons having been placed already this month.

PIG IRON.—The unsettled feeling still continues. Buyers are anxious to secure concessions, but these are scarce. Most of the standard irons are well sold out, and only small lots can be had for immediate shipment. No great activity is discernible, and the market is largely a waiting one. Prices for Philadelphia and vicinity are as follows: No IX foundry, $16 to $16.50; No. 2 X foundry, $15.50 to $16; No. 2 plain, $14.75 to $15.25; gray forge, standard brand, $14.50 to $15.

FINISHED MATERIAL.—The volume of business still keeps up. Demand for plates and structural material is heavy and prices hold firm. Bars are a trifle quieter, and there is a disposition to shade prices somewhat. Sheets are in strong demand, and any change in price will be in the shape of an advance. We quote: Best refined iron bars, 1.45c to 1.55c; steel bars, 1.40c to 1.50c; plates, ¼-inch thick and thicker, 1.55c to 1.60c; beams and channels, 1.65c to 1.75c; sheets, No. 10-12, 1.80c to 2c; No. 14, 2.05c to 2.15c; No. 16, 2.20c; No. 20, 2.60c to 2.70c; No. 24, 2.90c; No. 27, 3.10c; No. 28, 3.20c.

OLD MATERIAL.—Prices remain about the same, and no new conditions are apparent. Quotations are as follows: Choice railroad scrap, $17.50 to $18; No. 1 yard scrap ordinary, $14 to $14.50; No. 2 light scrap, $12 to $12.50; machinery cast, $14 to $14.50; heavy steel scrap, $14.25 to $14.50; old iron rails, $17.50 to $18.50; old steel rails, $15 to $15.50; wrought turnings, $10 to $11; cast borings, $8 to $8.25; old car wheels, $17.50 to $18.

The Carrie Group of Furnaces.

During the coming year the Carnegie Steel Co. will entirely rebuild and enlarge the two furnaces of the old Carrie plant, a contract having been let last week to James Lappen & Co. of Pittsburg for the tearing down of furnace No. 2 and the reconstruction of the stack and stoves. This furnace is 80 feet high and has been in continuous operation for the past three years. It is one of the oldest of the Carnegie furnaces and has a daily capacity of about 300 tons. It will be blown out the latter part of this month and will be immediately dismantled. The new stack will have the same dimensions as the other two furnaces at this plant now nearing completion, namely, 105 feet high and 20 foot bosh. The daily capacity will be about 700 tons. As soon as this furnace is about ready to blow in the remaining old furnace will also be torn down and dismantled and reconstructed similarly. On the completion of the work the Carnegie Steel Co. will have in the Carrie plant a furnace group unsurpassed in the world, the daily capacity being 2,800 to 3,000 tons. The furnaces will be in a row facing the Monongahela river and will be on the hot metal route to the Homestead steel works, the bridge for which was recently completed. The two new Carrie furnaces which have been under construction by the Riter-Conley Construction Co. of Pittsburg, will not be completed until about March 1, although it had been expected that they might be blown in about January 15.

Sheridan furnace No. 1, at Sheridan, Pa., will be blown in shortly.

A WEEK OF "HIGH INDUSTRY."

The week has been prolific in "news" of various iron and steel enterprises following in the wake of the announcement of the Carnegie tube works for Conneaut. First in importance, if true, is the report that J. Pierpont Morgan is planning such a "community of interest" program for the big steel companies as has been developed of late for certain railroad systems and important coal properties. A long dispatch, originating at Philadelphia, announces the pendency of negotiations by which Mr. Morgan and associates will secure control of the Carnegie Co. by buying Mr. Carnegie's interest. Asked about this report Mr. Carnegie is reported to have said that there is no truth in it so far as he knows, and to have added: "The idea is in the air, just as the railroad combination is; but it is only an idea. What a combination that would be!" Of the Carnegie Steel Co. he said in the same connection, answering the question whether his company were in any sense on the market: "It is not in the market. It is prepared to do business, of course, but always in a friendly co-operation with others."

A second report came in a cablegram from London, and was in substance that representatives of various steel concerns in Canada and the United States were in that city planning for a combination of English, Canadian and American companies. The Otis Steel Co., Pittsburg Steel Co., Canadian Steel Co., and Wellman-Seaver Engineering Co. were named as parts of the aggregation. There is no Pittsburg Steel Co. and the Canadian Steel Co., which is reported to have plans for a steel works at Welland, Ont., is little more than a thought. The whole story seems to have grown out of the fact that various persons connected with certain of the above companies were in London at the same time, together with Geo. D. Wick and S. V. Huber, representing the proposed Youngstown tube company. It has no foundation in fact.

A third scheme evolved to the extent of several columns of newspaper space relates to a steel works, blast furnaces, etc., to be erected by the "steel trust" and to be operated "in opposition to the Carnegie Steel Co.'s Conneaut project." The site, according to some reports, is at Willoughby, O., and according to others the marsh located between Willoughby and Mentor, O. The Pittsburg Coal Co. was reported to be co-operating with the "steel trust" in the matter and to have under way plans for the Pittsburg, Youngstown & Cleveland Railroad Co., which was to build a road from Pittsburg to Willoughby and establish docks at the latter place. Officers of the coal company deny any knowledge of or connection with the project, and thus far the particular "steel trust" moving in the matter has not been located. At Willoughby the lake shore is a shale formation, which would scarcely be considered promising for the making of a harbor. The "marsh" between Willoughby and Mentor could only be converted into a harbor at very heavy expense. Fairport, which has not been mentioned in these recent stories, is without doubt the most promising locality on the south shore of Lake Erie for a steel enterprise, if one is seriously contemplated. It is safe to say that engineering offices are not being crowded to get out plans for any Willoughby-Mentor project, though railroad surveyors have doubtless been on the ground.

Again a Rod Mill Record.

No. 2 rod mill of the Illinois Steel Co., at Joliet, produced in the 48 turns in December 9,643 gross tons of No. 5 rods, or an average of 201 gross tons per turn. The best turn in the month was the night of Dec. 17, when 245 gross tons were made. This is the world's record.

The directors of the American Tin Plate Co. at their meeting on Jan. 15 declared a dividend of 8 per cent on the common stock, payable quarterly. The directors of the Federal Steel Co., meeting the same day, declared a dividend of 5 per cent on common stock for the year 1900, payable Feb. 20. No action was taken regarding an amendment to the constitution permitting future dividends to be paid quarterly.

The report that the Shelby Steel Tube Co.'s sales and auditing offices, now in Cleveland, will be removed to Chicago, and that the operating department offices will go to Shelby, O., has been officially denied.

LAKE SUPERIOR IRON MINES.

The three Minnesota ore roads have presented a petition to the new railway commission of Minnesota, asking that the order given by the old commission, reducing iron ore rates from the Mesabi and Vermillion districts to the docks at Two Harbors and Duluth, be set aside, and that the case be opened for further argument. It is claimed that the order of the commission virtually attempted to fix rates on interstate business, over which the commission had no control. The order required the railroad companies to haul ore from the mines to the docks, unload it into the pockets, and thence to the vessels on a basis of 60 cents per ton. The last operation, it is claimed, makes the business interstate, and hence it is not in the province of the commission.

The Minnesota Iron Co. is sinking a shaft on the north side of Soudan Hill, and will go down 250 feet, at that level running a drift 2,000 ft. to Montana shaft, now out of commission. The drift will cut several lenses of ore found by the drill, and the ore will be taken out by Montana shaft. Drifts have also been run at a depth of 950 ft. to open ore found by drill some time ago. The deepest mining now carried on is at the 850-ft. levels. The company has drill holes a good deal below the ore found at 950 ft., and has found several excellent lenses at various points.

A second shaft will be sunk at the Duluth mine on the Mesabi range this winter. All the ore now comes from a milling pit. The shaft house and buildings destroyed last fall are rebuilt, and mining goes on steady.

The Oliver Iron Mining Co. will not open up the Stevens mine on the Mesabi range this season, but will work its mines already opened. The company is taking machinery to its explorations at Mesabi Station, where work will be pushed all winter.

The property known heretofore as the Voos is now the Bird, and the company operating it is the Bird Iron Co. The company is an Illinois concern, and has a capital of $50,000. Its officers are: President, Geo. B. Penwell; secretary, M. S. Sanders; treasurer, E. E. Crepin; superintendent, A. E. Buzzo; directors, Geo. B. Penwell, John Crerar, R. F. Clinch and M. S. Sanders. Crerar, Clinch & Co. are sales agents. The company has almost the same personnel as the De Soto and Huron Iron companies, operating the Mansfield and Columbia mines, and spoken of as the Crerar-Clinch interests. The Bird Iron Co. will develop the ore deposit discovered by Geo. Voos and others on section 13, 43-32, in the Crystal Falls district. This ore showed at first a high-grade Bessemer, but this soon ran out, leaving ore of about 52 per cent in iron, low in phosphorus.

The Mansfield mine, located near Crystal Falls, Mich., has passed from the De Soto Iron Co. to the Oliver Iron Mining Co. The mine produces a high-grade Bessemer ore, and is in good shape. S. C. Bennett, lately with the Corrigan-McKinney mines, will be in charge of the property.

A delegate convention of blast furnace employes, each of the 29 furnaces in the Mahoning and Shenango valleys being represented by two or more delegates, was held at Youngstown, O., Tuesday, Jan. 15, to take action regarding notices posted by the operators that on Feb. 1 the base rate of wages would be reduced from $1.90 to $1.65 per day. Resolutions were unanimously adopted rejecting the proposed reduction, and giving notice to the operators that, if the cut was insisted upon, a general strike would be ordered, taking effect Feb. 1.

The Seamless Steel Tubes Co. of Detroit has completed its plant and is ready to enter upon the manufacture of seamless steel tubes, for steam engineering and other purposes. The best grade of open-hearth steel will be used, manufactured especially for this purpose. The company's facilities cover sizes from 1 inch to 3½ inches outside diameter. The officers of the company are: President, Hon. James McMillen; vice president and general manager, William Thornburgh; secretary and treasurer, W. C. McMillen; auditor, Geo. M. Black. The offices are situated at 804 Union Trust Bldg., and the plant at 833 River St., Detroit.

T. J. Easter, agent for Connellsville coke, Lewis Block, Pittsburg, has mailed as a trade souvenir, a jointed steel foot rule.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

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WAR PROSPECTS IN THE IRON TRADE.

Ever since the consolidation movement in the iron trade went far enough to give a measurably clear idea of the lines on which six or eight leading interests were moving, speculation has been busy with the possibilities of conflict between them. Outside competition, as threatened from time to time, has had attention, too, but the status has not been regarded as so seriously assailable from any external quarter as from within. The history of the past two years has shown that the observation frequently made when the combinations were forming that a few large interests could and would maintain an understanding much better than many small ones, was quite accurate. No sudden sundering of relations between buyers and sellers of unfinished steel resulted. All the steel companies set about increasing and improving their pig iron equipment and acquiring ore properties or adding to those already owned; but while they made no ceremony about parting company with sellers of ore and sellers of pig iron, good care was taken to preserve friendly relations between steel makers. The famous rail war of 1897 and the threat of a third armor plate works that followed was still a vivid memory, and while every company did its utmost to strengthen its lines, even to buying ore properties that some of its rivals wanted, these preparations seemed rather to look to the maintenance of peace than to its rupture. Trade conditions seemed made for the preservation of peace. No pool agreement could stand in the same reckoning as a supporter of prices, with such a pell mell rush to place orders as buyers made in the boom of 1899.

Last year the test came under months of abstinence from the market by buyers who thought to make up for their heavy precautionary purchases of the preceding year. There was throughout it all evidence of frequent conference and reasonably good understanding among leading interests. The developments in the wire trade in April and some of the questions concerning contract fulfillment that were connected with them, seemed for a time to threaten the status; but the year passed without the precipitation of the much predicted war between the large companies.

Early in 1901 has come an announcement accepted in many quarters as the first gun in a long-drawn battle. A few comments on the Carnegie project for a wrought pipe and tube plant at Conneaut have given more weight to motives for the announcement than to the enterprise itself; but the general sentiment in the trade and the correct one, we believe, accepts the plans as facts and seeks to discover to what they will lead. The tenor of many articles that have appeared in the past week is that the conflict of the giants has begun and that the Conneaut plans are only an introduction to much more affecting other products. Some of the statements would even seem to imply that the big companies are on a war footing from choice and that much of the energies of each will be employed from this time on to circumventing the plans of rivals and to entering new fields of which others have made a specialty. This is far from the true view of the situation.

So far as the Conneaut project is concerned, the existence of the Carnegie railroad connecting with the Connellsville coke region, and tapping coal fields was one factor; the unwillingness of railroads to give Pittsburg steel makers as low rates as other steel making districts enjoyed, a second and leading factor. The fact that the new project meant blast furnaces and steel works also, and thus would afford no outlet for the surplus from the steel works the company already has was one reason for incredulity. But it is known that the merchant bar plant just completed will afford such an outlet in part, while there are reasons for believing that other steel tonnage of the company will find its way to the market in the form of sheets, if plans now being considered are carried out. But apart from this, there never has been any reason to believe that the Carnegie Co. with its enormous ore reserves and its great selling organization would content itself with simply rounding out its present blast furnace and steel works capacity with such finishing mills as would work up the product of the former. Wrought pipe runs rapidly into tonnage, taking the average of sizes; the industry was not in danger of being overdone, and the demand was growing the world over. Conneaut Harbor was 154 miles from the Bessemer terminus of the Carnegie road. Connecting at Bessemer with the B. & O, railroad the Carnegie line would have a 154-mile haul on Connellsville coke which the latter would bring to it for works at Conneaut. Eighty miles from Conneaut Harbor the Carnegie line passed through the Mercer coal district, from which it could carry the coal needed for the Conneaut works, and both the coal and the coke would be carried by trains most of which otherwise would go back to Conneaut as empties. The shipping facilities of Conneaut by water and by rail were a great inducement and Conneaut had plenty of land, whereas the limit on large available tracts had been virtually reached in the Pittsburg district. It would seem that all these considerations, and most of all the need of rebuking the short sighted policy of the railroads, which seemed to feel that they could levy tribute not only on the Pittsburg industries of today, but on all that might grow out of them, are quite explanation enough of the step the Carnegie Co. has taken.

We do not share the fears of some that the relations

ize profits in the iron trade. We believe that one or two large competitors would be better for any producer that for the time being virtually controlled production in a given line, than a dozen smaller concerns. The country's consumption of iron and steel is an expanding quantity. In whatever line the expansion is most rapid competition will be most apt to spring up. The past two years have shown that relatively small concerns are starting and will start up to engage in lines of iron and steel manufacture which large companies are presumed to have well in hand. Some of these have been bought up, and the probabilities are that others will start with like expectations. It is a question whether the entrance of the large steel companies upon new lines, as the demand expands, would not result in the end in better conserving the interests of all—producers and consumers—than the expensive process of attempting complete or almost complete control in a given line by the absorption of minor competitors who might enter the lists fi the big ones did not.

The Conneaut project is not necessarily a signal for war in the steel trade. It would require two years for the carrying out of such a program as that outlined by the Carnegie Co. The world's needs are likely to increase greatly meantime, and the plans of our steel makers for the disposal of large tonnages abroad will have developed into settled policy. There has been a very considerable abandonment of unfit plants in this country in the past two years, and more of this will come in the near future. It is only natural that extensions should be made to take care of increasing consumption, and likewise natural that such extensions should be made by the strongest and fittest, and that their advent should be without serious shock to the relations that exist.

It would appear that the reductions in freights announced by the railroads are still unsatisfactory to steel producers in the Pittsburg district. After making the expressions attributed to him in the interview quoed elsewhere in this issue Mr. Carnegie has made public a statement in which he says he was misled as to the extent of the reduction proposed, having the understanding that it was to be to 4.8 mills per ton per mile, while in fact it is only 6.7 mills to Philadelphia and Baltimore and 6 mills to New York. Heretofore the rate to Chicago has been 8 mills and is now made 6 mills, though Mr. Carnegie alleges Chicago mills can ship west of that city at 3 mills. He adds:

"It will seem incredible to Pittsburg manufacturers that, till now, producers have been compelled to pay our home railroads 2½ times as much per ton per mile as steel manufacturers in Chicago pay on their steel for equal distances. * * * I wouldn't put one dollar in Pittsburg today upon any consideration whatever, nor will I ever consent to do so unless the Pittsburg railroads give us assurance that whatever rates the steel manufacturers get in any district of the United States they will give us. In my opinion the policy of attempting to charge Pittsburg manufacturers higher rates than others pay is suicidal both to Pittsburg and its railroads."

The Dover Fire Brick Co., Cleveland, O., is sending out as a New Year's reminder, a nickel and enamel match safe, one side of which presents a view of the company's works at Strasburgh, O.

The announcement is made that Frank H. Miller has withdrawn from the firm of Miller, Wagoner, Fieser & Co., Columbus, O., to devote his entire attention to the affairs of the Columbus Iron & Steel Co., and that the business of Miller, Wagoner, Fieser & Co. will be conducted by Fieser, Wagoner & Bentley, who will continue the manufacture of Bessie ferro-silicon and silvery pig iron, and Hocking American Scotch and strong foundry irons, made of Lake Superior and native Ohio ores. The offices will remain in the Wyandotte building, Columbus, O., and the Monadnock building, Chicago.

The Massillon Iron & Steel Co., Massillon, O., is reported to have completed arrangements for increasing the capacity of its plant.

PERSONAL.

It is reported that Gorge D. Wick and S. V. Huber, the latter a mechanical engineer from Pittsburg, are in London at present investigating the method of pipe and tube manufacture by the Perrin process. An experimental plant is in operation at Wolverhampton, Eng. If it is found to be satisfactory and terms can be made, it is probable that this method will be used in the new tube plant of the Youngstown Sheet and Tube Co. to be erected at Youngstown, O.

John W. Grady, formerly chief inspector of steel at the 29th street mill of the Carnegie Steel Co., Pittsburg, has been appointed successor to J. W. Parker, deceased, as inspector of steel at the Homestead Steel Works and the Howard Axle Works.

William Richards, formerly assistant general manager of the Duquesne Steel Works of the Carnegie Steel Co. and who resigned several weeks ago, left Pittsburg last week for Sydney, Cape Breton, to take full charge of the finishing mills of the Dominion Iron & Steel Co.

H. F. J. Porter, M. E., of Bethlehem Steel Co., addressed the engineering students of Armour Institute of Technology, Chicago, on Tuesday evening, Jan. 15, on "The Development of the Art of Forging." The lecture was illustrated with 50 stereopticon views.

The American Bridge Co. announces the following appointments: E. W. Stearns has been made manager of the East Berlin, Ct., plant. Frank S. Moore has been made manager of the Lafayette, Ind., plant. All the Pittsburg plants have been consolidated into one, and J. W. Walker appointed as manager. C. A. Billings having been appointed assistant treasurer for the New York district, H. W. Post has been appointed manager of the Post & McCord plant.

E. A. Kern, of Niles, O., has been appointed general superintendent of the four mill sheet iron plant which is to be built at Hazelton, O., by the Youngstown Iron & Steel Roofing Co. Mr. Kern was formerly superintendent of the Falcon Iron & Steel Co. at Niles, O.

W. E. Corey, superintendent of the Homestead Steel Works, Carrie furnaces and Howard Axle Works of the Carnegie Steel Co., sails for Genoa, Italy, on the 22d, for a three months' tour of Europe.

President J. L. Greatsinger, of the Duluth & Iron Range Road, who also became president of the Minnesota Iron Co. on Jan. 10, entered railroad service in 1869, as fireman on the Erie road. In the next 16 years he held the position of machinist, engineer, train master, road master, train dispatcher, station agent, master mechanic and superintendent. In 1886 he went west as master mechanic of the Chicago & Indiana Coal Railway Co. In 1888 he became master mechanic of the Duluth & Iron Range road, in 1890 superintendent and in 1892 president. He is an expert telegraph operator and occasionally sits down at the key and talks over the line with his superintendent or others. A newspaper reporter a few years ago found Mr. Greatsinger at 2 o'clock in the morning at the telegraph key talking with the foreman of a train wrecking crew.

Stike Expected at Valley Furnaces.

(Special Telegram.)

PITTSBURG, Jan. 16.—The blast furnace employes in the valleys have presented demands to the furnace operators for a 10 per cent increase. A meeting of the operators will be held within a few days to take action upon these demands. There is little doubt that the reduction already decided upon will go into effect on Feb. 1 and a strike is looked for that will tie up all the furnaces in the valleys.

As a result of the bi-monthly examinations of the sales sheets of the American Sheet Steel Co. made last week there will be no change in the wages of the sheet mill workers of the Amalgamated Association of Iron, Steel and Tin Workers for the months of January and February. Puddling will remain unchanged also, as a result of the examination of sales sheets of the bar mills made last week at Youngstown, O.

The Robert Aitchison Perforated Metal Co., 303 Dearborn St., Chicago, is busy on orders for perforated metals for use in fanning mills, ice machines, clay screens and cotton seed oil machinery, besides small orders for repair work. The year 1901 is starting out with every evidence of continued prosperity in this line.

AMERICAN MACHINERY TRADE AND RUSSIAN RECIPROCITY.

The Ingersoll-Sergeant Drill Co. sends out a circular letter designed to stir up the interest of manufacturers of machinery in one phase of the reciprocity policy of the United States—or rather in one result of the attempt to modify that policy by putting one commodity on a protective basis. One thing is certain, and that is that the establishment of a reciprocity policy has opened the door to some very poorly disguised attacks upon our protective tariff system. The original purpose of reciprocity was to secure free access to foreign markets for American agricultural and manufactured products by relieving from the payment of duty certain products of the country with which the special treaty was made. The intention was to select such products for free entry to United States ports as did not compete with home products, and on which the ordinary duties were therefore revenue duties and not protective. As so understood the policy of reciprocity found favor with both protectionists and free traders. But there has come a very considerable departure from the original lines of reciprocity treaties. Certain producers have pressed for these treaties with countries whose products in some cases would be able to compete with home products, where no duty had to be paid. Thus a conflict of home interests resulted, as in the case of the Russian treaty referred to below, and we have one set of manufacturers urging a modification of the treaty, while others insist that it be carried out as made. As the matter is put by the Ingersoll-Sergeant Drill Co., the larger benefit certainly appears to fall in this instance on the side of treaty maintenance. But the case illustrates the complications that result from departing from a settled policy and attempting to make a new rule for each country with which a trade treaty is made. A broad, consistent policy of protection looks to the good that will come to the whole country by the largest development of a diversity of industries at home, making this the best market for every manufacturer to sell in, and treating the foreign market as subsidiary and supplemental.

Some months ago we printed and commented on a letter from a firm of machinery manufacturers, who advocated cutting off or reducing many of our duties on the ground that while they were no longer needed for protection, they were obnoxious to foreign countries and provoked them to the levying of retaliatory duties on American products. We remarked then that the thing that troubled our foreign competitors was not so much the existence of our protective tariff, for that they have always connected with us, but the fact that we were getting some of their trade not only on neutral ground but in their own home territory. We realize that in the fierce world struggle for trade that is now on and that is destined to become more and more intense, our manufacturers should have no handicaps at home; but it is well to remember that the policy which brought many of our industries to the splendid position they hold today is still the policy on which other of our industries must depend that have not reached the same stage of development. Following is the text of the Ingersoll-Sergeant Drill Co.'s letter:

"An effort is being put forth by the beet sugar interests of this country to prevent the importation of beet sugar from Russia by having the Secretary of the Treasury abrogate the clause in our present reciprocal arrangements with Russia, wherein the said sugar is brought into this country under the favored nation rate of duty. This will prohibit any further imports of sugar from Russia by putting in force the tariff of the Dingley bill against said sugar, which will with the internal revenue tax, if the sugar manufacturers of Russia must buy their own goods, effectually put a stop to any further importations from that quarter. While the Ingersoll-Sergeant Drill Co. do not contend that the beet sugar interests shall not have the widest possible scope in the exercise of their rights, we do, however, maintain that it is the duty of every American manufacturer to take warning as to how his own interests are to be affected by this proposed action.

"If the Secretary of the Treasury carries out the arrangement which has been proposed, and which we believe is suspended for about sixty days, it will be promptly met by retaliation from Russia in the shape of an increase in duties against all classes of American manufactured goods, ranging from 25 per cent to 30 per cent. This will be in effect also prohibitive as to any further exports from this country, and there will be left in the lurch hundreds of American manufacturers with half complete orders on their hands and a new basis of estimates as to expenses which can hardly be met by increase of numbers, as many of the goods which are now being made in American factories to be consumed in Russia, have been arranged for by specific contracts, which contracts take no account of course of the changes in existing tariff, such changes being entirely unexpected.

"You have, we assume, the fullest access to the tables of the Treasury Department as to imports and exports, but if our source of information is correct the total value of sugar imported from Russia during the fiscal year ending June 30th, 1899, was but $340,000 while during the same period this country sold to Russia manufactured goods amounting to $10,000,000. We are told that during the first ten months of 1900 we sold to Russia $9,440,000 of goods. This of course means goods sold direct and going into Russia via the Baltic and Black Sea ports, and takes no account of the millions of dollars' worth of goods which have been imported into Russia via England and Hamburg.

"It is our belief that the National Association of Manufacturers of America should form committees and deputations, and every company or private concern, whether a member of this Association or not, should in every way possible prevent the consummation of this very radical action. The public should be informed, if it does not already know, that upon the completion of the Trans-Siberian Railway system the field which will be offered in Siberia for American machinery of all kinds will be unprecedented. You are of course aware that under our present arrangements all articles manufactured in this country are admitted absolutely free of duty to the port of Vladivostock and other Asiatic ports of Siberia and Russia.

"We are writing you on this subject, as we have written the National Association of Manufacturers of America, hoping to have your co-operation and interest in giving the manufacturers of America the fullest possible warning before this radical action is taken by the Treasury Department at Washington. Our interest is to encourage and not discourage foreign governments to admit American manufactured products free of duty, and this measure to which we have referred if carried out will seriously curtail opportunities for doing foreign business. We would therefore like to have the co-operation of the scientific press in preventing this action."

Obituary.

Walter Steel, one of the founders of the Carpenter Steel Works, of Reading, Pa., died at his home, from blood poisoning, Jan. 9. Mr. Steel was general manager of the Philadelphia Steel & Iron Works, at North Reading.

Clement Hackney, at one time general superintendent of motive power of the Union Pacific road at Omaha and for the past twelve years general manager of the Fox Pressed Steel Car plant at Joliet, Ill., died at his home in Milwaukee Jan. 6, aged 57. He recently returned from Europe, whither he went for treatment.

J. C. Pearson, prominently identified with the iron and steel trade of New England, died at his home in Boston, Wednesday, Jan. 9, from an operation for appendicitis. He was 38 years old. Mr. Pearson was a wire nail jobber and dealt largely with the American Steel & Wire Co. He developed and controlled the manufacture of the cement coated nail, which is covered with a rough, sticky substance, by reason of which it takes a stronger hold on wood and is not so easily drawn out as the ordinary nail. Mr. Pearson was also interested in various industrial ventures.

Philip James, who puddled the iron for the first T-rail in 1831 at the Dowlais Iron Works, Dowlais, Glamorganshire, Wales, died of pneumonia at his home in Allegheny, on Jan. 15. He came to the United States in 1837, securing work as a puddler at Peck's Iron Works, Haverstraw, N. Y. He moved to Pittsburg when there were but 49 furnaces in the entire Pittsburg district, the largest mill in the city being equipped with only 8 puddling furnaces. In 1869 he became manager of an iron mill at Irondale, O., and rounded out his 57 years in rolling mills as night boss of puddlers in the Oliver Woods Run mill.

A MOVEMENT FOR THICKER BOILER PLATES.

A report on boiler plates, in connection with the idea of increasing the limit of thickness, has just been made by R. S. Hale, consulting engineer of the Mutual Boiler Insurance Co., Boston, and is as follows:

It is not many years since the boiler insurance companies set ther faces against anything thicker than 7-16-inch plate for plates exposed to the fire, and nearly everyone remembers the time when the United States rule forbade plates thicker than ¼-in. to be exposed to the fire; I should not want to say that this rule was not still in force. One of the prominent engineers of the country last year specified 17-32-in. plates for some boilers to be insured by the Mutual Boiler Insurance Co. which, after some consideration, was approved.

The size of boilers now made is larger than was formerly considered the best practice. Not many years ago a 60-in boiler was the standard, today 72-in. is the more common, and many boilers of 78, 84 and even 90-in. are being built. Pressures have also increased. Formerly the standard pressure was 80 pounds; today it is 125 and 150 pounds. Now the larger the boiler and the higher the pressure that is carried the lower will be the cost of installation and of operation, and the limit to further increase of size or pressure is the limit to the thickness of the shell plates, which at present are seldom made thicker than ½-in. For steel of 60,000 pounds tensile strength, with a quadruple riveted joint of 90 per cent efficiency, and a factor of safety of 5, this limits the pressure to 180 pounds in 60-in. boiler, to 150 pounds in a 72-in. boiler, and to 120 pounds in a 90-in. boiler, while, with 7-16-in. metal, which is more commonly used than ½, a 72 boiler with triple riveted joint carries only 125 pounds pressure. If 90-in. horizontal tubular boilers could be made to carry 150 to 180 pounds of steam pressure, they would compare very favorably with even the best water tube boilers in price and economy, and it will therefore be of interest to determine whether thicker plates than ½-in. may not be used.

It is interesting to note the reasons for the old and present limits. If the plates are not exposed to heat or are exposed to the heat of the steam only, there is apparently no difficulty with plates 1 inch thick and even more, but if plates are exposed to the fire it is thought they reach a dangerous temperature. What temperature will they reach? I am not aware that any absolute experiments have ever been made of the temperature of the surface of the water side of a plate, since such tests would be very difficult, but the work on cylinder condensation in engines, and in fact almost all work on conductivity, indicates clearly that the water side of a plate never exceeds the temperature of the water in contact with it by more than a very few degrees, if it exceeds it at all. With oil or scale on the water side this would not be the case, but oil or scale would affect thick and thin plates by the same amount.

On the other hand, the side of the plate exposed to the hot gases is, it is known, much cooler than these gases. This difference has also never been measured directly, but the temperature of the plates may be computed as follows: For a constant temperature of the inside of the plate the outside of the plate will reach its maximum temperature when the plate is transmitting the maximum amount of heat. Boiler tests and conductivity tests indicate that the maximum heat transmitted per square foot per hour is the evaporation of from 20 to 50 pounds of water from and at 212 degrees, or, taking the higher figure, 43,800 B. T. U. per hour. The conductivity of iron is given variously at from 0.11 to 0.18 in the C. G. S. units. If we take the conductivity as 0.1 and the flow of heat 48,300 B. T. U. per square foot per hour, we find that the difference of temperature between the inside and outside of a 1-inch plate is only 168 degrees F. This probably represents the worst ordinary conditions, though for what is known as blowpipe action the difference may be more. For a ½-inch plate the girth seam is 1 inch thick, and 168 degrees would be the greatest difference of temperature between the inside and outside. If the steam pressure is 150 pounds, the temperature of the water side will be 365 degrees, and of the outside of the plate, 537 degrees. If the plates are 11-16 the outside will be 63 degrees hotter, or 600 degrees, the inside being the same. Now, in steam superheaters, which are used extensively abroad, the temperatures of the steam reach 700 degrees, and yet the thin steel tubes of the superheater do not suffer, although they must be themselves at a higher temperature than the steam, and above 700 degrees.

Hence it follows that even 11-16-inch plate will not reach as high a temperature as is used without trouble in superheaters. The old ¼-inch rule gives an interesting result. The water side of a 38-inch plate in a boiler worked at 100 pounds would be 338 degrees and the fire side 391 degrees in the body of the plate where it is ⅜ inch thick and 464 degrees at the girth seam, where the thickness is ¾ inch. The temperature 391 degrees corresponds to only about 210 pounds pressure, at which pressure many boilers are worked today. Now the ⅜-inch plates in the old days gave as much trouble from blisters in the body of the plate, where the metal was only ⅜ inch thick, and temperature of the fire side not over 391 degrees, as they did at the girth seams, where the temperature ought to have been greater.

These facts show that the plates of superheaters and high pressure boilers are today worked at much higher temperatures than occurred in the old iron plates which gave trouble, and it follows that the reason for thin plates lay in something more than the mere question of temperature. It was probably due to some difference in constitution between the old iron plates used when the ¼-inch rule came into effect and the steel used today in superheaters and high pressure boilers. The laminations of the iron plates are a sufficient reason to account for this at once. If a lamination existed there would be an additional resistance to heat transfer at the lamination, and the outside of the sheet would naturally reach a very high temperature and cause trouble by blistering, while this would not occur with homogeneous steel.

Now this theory, that it was the laminations in the iron plates, and not the actual temperature reached, that was the foundation for the old limit to thickness, is only a theory, but when it is combined with present day practice of using ⅜, 7-16 and ½-inch plates of homogeneous steel, it indicates that we probably have not yet reached the limit of thickness. The Mutual Boiler Insurance Co. has today under its insurance many boilers with ½-inch plates, some of which have been in service for ten years. Of these only one has given trouble, which is as good a record as would be expected with 7-16-inch plates. It therefore is probable that ½-inch is not the limit, and we are prepared to approve specifications calling for 9-16-inch plate of the best steel, which, with quadruple rivited joints, will allow 170 pounds pressure for a 72-inch boiler, with a factor of safety of 5, or a pressure of 135 pounds in a 90-inch boiler, with the same factor of safety.

A 90-inch boiler can easily and economically be worked to 300 horse-power, and would cost, set and in place, about $2,000, or $6.66 per horse-power. Such boilers have been worked at good economy to 400 horse-power, and with some loss of economy, to 700 horse-power. At a rating of 400 horse-power the cost is only $5 per horse-power. Of course this does not mean that we will guarantee that these thicker plates will never give trouble, any more than we guarantee that ½ or 7-16-inch plate will never give trouble. It is our opinion, however, that there is but slight risk of trouble, and no more risk of explosion than with the thinner plates, and we recommend such of our members as want a cheap, good, high pressure boiler at least to consider the use of such plates.

Columbia University recently announced that students desiring it can now take a course in motor vehicle construc- vehicle has now become such a factor in commercial and private use that it is deemed as essential that a mechanical engineer should now be as well posted in motor vehicle construction as in marine, stationary or locomotive engineering. Some time ago the International Correspondence Schools, Scranton, Pa., announced a course in gas, gasoline and oil engines, in which special attention is given to the application of these engines to motor vehicles.

The Youngstown Foundry & Machine Co., Youngstown, O., recently took a contract for a very large lot of machinery for the National Steel Co., at Youngstown. The company is so rushed that it has been compelled to refuse orders for prompt shipment, not being able to make delivery. This concern recently installed a 36-inch lathe, 27x36 feet, from the Pond Machine Tool Co., at Plainfield, N. J.

HARDWOOD LAGGING AND ITS APPLICATIONS.

A development of the past few years, with the growth of industry in all lines is the increasing number of concerns engaged in the buying and selling of second-hand material. Particularly is this noticeable in machinery, where anything from a monkey wrench to a locomotive can now be had. This field of buying and selling second-hand equipment seems to be practically unlimited, and is due to the constantly increasing and changing demands of the thousands of manufacturers in the country, who owing to excessive competition which has created the necessity of producing articles at the minimum cost have had to centralize their power plant and equipment and adopt new methods of manufacture. The result of these re-arrangements has been to throw out of use a never-ending lot of machines which may have been well thought of in their day, but were abandoned because the business has outgrown their usefulness. What was at one time considered more as dead stock now readily finds a market, and it is here where the machinery broker steps in and becomes a sort of clearing house for all discarded equipment.

Perhaps the principal product falling to the brokers' hands is boilers and engines, the engine being the greater element of

FIG. 1.—HARDWOOD LAGGING AS APPLIED TO A BALANCE WHEEL AT DELLS PAPER AND PULP CO., EAU CLAIRE, WIS.

value. Should any one desire a stationary engine, which for any one of many reasons may have found itself in the hands of a machinery broker, this may be done with but little trouble and at an attractive price as compared with the cost of a new engine. Immediate delivery is also secured and this in a great many instances is an important factor and influences the purchase. As every engine is supplied with some sort of a driving pulley or balance wheel, neither of which may be suited to the purchaser's requirements, a proper driving pulley must be provided and the usual course is to proceed to the nearest machine shop and contract for an iron wheel, have it turned for a belt transmission or rope drive, and exchange the old wheel towards the purchase price of the new. A quicker, simpler and cheaper method of accomplishing the purchaser's needs in this line is brought out and shown herewith in the applications of the hardwood laggings as manufactured by the Dodge Manufacturing Co. of Mishawaka, Ind. They are shown in practical use in the illustrations accompanying this article.

The case is cited of an engine supplied with a balance wheel. Hardwood lagging was used in such a situation in the paper mill of the Dells Paper & Pulp Co., Eau Claire, Wis., as shown in Fig. 1. It was in order to provide against any possible failure of their water supply that this concern decided to install a steam plant. They secured a second-hand stationary engine which was supplied with an 18-foot 15-inch square rim balance wheel weighing 50,000 lbs. As the balance wheel was not suitable for driving purposes, it was either necessary, in order to use the engine to secure a new driving pulley or lag the old one up. In figuring the cost of a new driving pulley and of lagging this balance wheel, it was seen that a saving of about 50 per cent in the cost of exchanging this balance wheel towards the purchase price of a new wheel would be made by using the hardwood lagging, and contract was accordingly given. The lagging is 44 inches face, being grooved for eighteen 1½ inch ropes and is capable of transmitting 750 horse power. The internal diameter is 18 feet, while its pitch diameter of ropes is 19 feet. The balance of the rope transmission equipment, consisting of driven sheave, automatic take-ups etc., were purchased of the Dodge Co. as well.

At the plant of the Citizens' Traction Co. of Oshkosh, Wis., it was desired to transmit greater power than the old iron band wheel would allow. The increase in power was accomplished by the application of the lagging, which widened the face of the driving wheel and with the attending increase in diameter secured, together with the superior tractive qualities of the wood surface over the iron, a material increase in the amount of power transmitted from the original driver was made possible. The internal diameter of this lagging was 16 feet, the outside 17 feet with 37 inch face.

The re-arrangement of the power equipment of a plant is

FIG. 2.—HARDWOOD LAGGING. RIM IN HALVES READY FOR SHIPMENT

illustrated in the case of the Thos. Forman Co., Ltd., of Petoskey, Mich. In this instance the hardwood lagging converted a belt transmission into a rope drive. In 1899 when the company remodeled its plant, it was found necessary to change the line shafting and place it at right angles to the engine shaft, instead of parallel, as before. It was also necessary to drive a counter-line shaft at each end of the mill in opposite directions. This was accomplished by the application of the hardwood lagging to the engine fly-wheel, using four of the twelve 1¼ inch ropes from the fly-wheel with quarter twist to drive the shaft at one end of the mill. To have accomplished this with belting would have required heavy and expensive right angle belts and would also have taken up valuable space, apart from the expense of repairs.

Fig. 2 shows a hardwood lagging rim previous to shipment. The internal diameter of this rim was 14 feet with 15 feet pitch diameter of ropes. It was grooved for eighteen 1½ inch ropes for P. & F. Corbin, New Britain, Conn., who desired to transmit power from one building to another building located on the opposite side of the street. This was easily accomplished by the application of the lagging upon the engine fly-wheel and running the ropes through a tunnel under the street. The lagging displaced a belt transmission as well.

As the lagging increases the effective diameter of the fly-wheel, the linear velocity is increased by the greater diameter, the speed of rotation remaining the same. The fact of greater

co-efficient of friction or driving power of the wood surface over the iron is another feature to which attention is called. The construction of the laggings is the result of long experience and the use of special machinery and patented appliances. The construction as an entirety, is patented. The building up process requires a large force of active and expert men and numerous appliances, powerful presses, etc. The inside of the rim is then turned to fit accurately the face of the wheel upon which it is to go, being attached to it and the face either turned for belt transmission or grooved for a rope drive, as the case may be.

CHARCOAL IRON AND ROOFING PLATES.

The general tin plate trade has for years been looking for the discussion as to the relative value of roofing plates made with charcoal iron and those made with steel, to down, but is seems the question will not down. It would have been easy to settle the question long ago had it been possible to produce charcoal iron black plates precisely similar to those made in the earlier days, and to know for a certainty that they were absolutely similar. It would have been necessary merely to coat such plates by modern methods, or by such imitations of old processes as were possible, and observe the behavior of the product through a term of years exposed to ordinary conditions, or perhaps merely to some of the quick tests which are now made use of. But this has never been done. Some of the "charcoal iron" roofing plates which have been put on the market in the past few years have been more or less successful and have proved better than steel roofing plates. Others have not been better than steel plates, which perhaps they really were. With those which were better the question has been whether their superiority warranted their greater cost; the manufacturer has insisted that it does, but the consumer has not been convinced.

We say positively that conditions to prove the matter at issue have not been fulfilled, because there has not been a recognized definition of what the "charcoal iron" employed in the old days really was. Those who have claimed in late years to be using a similar material have given varying definitions as to what the process really was. It is claimed on some hands that the real charcoal iron must be made from charcoal pig iron which is refined at the furnace and is then puddled or worked with charcoal to eliminate the undesired carbon. Others claim that it is scrap worked over in a charcoal fire. The first named process would have been entirely too expensive and was probably never used for tin plate making in a commercial way. But the second process mentioned is far from furnishing a definition, because the varieties of scrap are legion. It would be an endless task to try all the varieties and combinations of varieties of scrap now available, and even then there is no guarantee that the kind of scrap formerly employed is now to be procured.

There is one fact that the advocates of steel cannot explain away with entire satisfaction. That is that there is a very large number of buildings which were roofed with the genuine charcoal iron roofing plate many years ago the material being intact today and furnishing a satisfactory roof covering. Roofs put on much more recently, with steel roofing plate, have failed and have required repair or renewal. As explaining the durability of the old plate, the argument has been put forth that in the old days the coating was heavier, or had a more intimate union with the black plate. If this is all there is in the matter, then it should not be difficult to duplicate the conditions as to thickness of coating or intimacy of union, and produce plates which shall be the equal of the old plates. There are those who claim that the black plate should be soft and porous, permitting the coating metal to enter the body, but a commercial difficulty intervenes here in that a large portion of the buying trade has become convinced, on wholly erroneous premises, that the quantity of coating is in direct ratio to the quantity which can be shaved off with a penknife, or at least that if metal has been used in applying the coating, and does not appear as an easily removable coating, it is lost so far as practical results are concerned. This is not necessarily the case. The relative position of iron, lead and tin in the electro chemical series may have an important bearing on the subject. Inasmuch as iron is more electro-positive than either lead or tin, it follows that if the most minute portion of the iron or steel plate is subject to the action of an acid, or even pure water or any liquid, a local electrical action is immediately set up which will attack, not the lead or tin, but the iron or steel, as being the more electro-positive. The black plate will be destroyed, while the coating will be left uninjured. That an action really takes place which this explanation fully fits, as far as it goes, whether it be the true one or not, no one familiar with the failure of roofing plates will deny. But if the explanation is correct, the source of the liquid which starts the action is not certainly explained, nor is it shown how the electrical action can be prevented. Possibly if the steel or iron immediately under the coating is thoroughly indurated or united in some particularly close manner with the coating metal the position of the metal is lowered in the electrical scale so that no electrical action will take place. In this connection it may be remarked that zinc is higher than iron or steel in the electrical scale, so that if the failure of galvanized iron and tin and terne plate were due to electrical action, the manifestation with galvanized iron would be entirely different from that with tin and terne plate, and this is precisely the case.—[Tin and Terne.

THE VROOMAN FOUNDRY RIDDLE.

The illustration below is of a novel form of foundry riddle made by H. S. Vrooman, 220 W. 20th St., Chicago, dealer in foundry supplies. The particular point claimed for the riddle is that the corrugation of the wire cloth in concentric circles, which is covered by patent, gives a great strength and

THE VROOMAN FOUNDRY RIDDLE.

rigidity to the bottom of the riddle, besides giving a greater screening surface than is had in the ordinary riddle. It is claimed the efficiency of the riddle over the ordinary flat bottomed riddle shows a gain of fully 50 per cent. The sand striking against the corrugations passes through more rapidly, and is caused to spread over a greater surface as it comes through. The riddle has been tried in actual foundry operations with very satisfactory results. The cost is little if any greater than that of the old style riddle. It will be made in any size, and strictly of first-class material.

In reply to an inquiry concerning a method of case-hardening malleable iron the *American Machinist* says: "Malleable iron may be case-hardened by heating it red-hot, rubbing cyanide of potassium over it, or by immersing it in melted cyanide, again heating and quenching in water."

De Camp Bros. & Yule, St. Louis, Mo., dealers in pig iron, foundry coke, furnace coke, etc., have issued a unique calendar. The art piece, which is a chemigraph, represents two molders pouring off.

THE MANUFACTURE OF STEEL WHEELS.

A correspondent of the *American Machinist* presents some interesting details on the manufacture of steel wheels. The article and the illustrations are reproduced herewith:

Steel wheels for use under various agricultural implements, engines, etc., have within the past few years almost entirely superseded the wood wheels—both those with wood and those with iron hubs. This has been due to the demand for a wheel that would withstand the heat of the sun as well as that of a steam boiler. The immense number of such wheels used has made it necessary to provide improved machinery and to adopt systematic methods for their manufacture. Any factory using such wheels can well afford to do this, if not less than three or four hundred are wanted per year. The manufacture of such wheels may not be in the line of machine work, but the construction of the necessary tools and appliances and the manner of using them may be useful and interesting to some of the readers of the *American Machinist*.

Fig. 5 shows the elements of a wheel of which a large number have been used, yet one which is not satisfactory. The spokes, having no collar on the inside of the rim, and being fastened to the hub by the nuts, as shown, are continually working loose. This wheel is also very expensive as compared with the wheel the manufacture of which will be described in this and a following article.

Fig. 1 shows the outlines of a riveting and punching machine used in this work. Fig. 2 represents the rim and spokes of a wheel as they come from this machine.

Fig. 3 shows an enlarged section of the rim with the spokes in place, one of which is riveted and the other to be riveted.

Commencing at the beginning of the various operations, we will follow the wheel through to a finish. The tire or rim, as we shall call it, is first cut to length, bent and welded in the usual way, after which the various improved methods and tools come into use. No attention is paid in the first operation to having the rim exact as to diameter. It is placed in a hydraulic tire-setting machine (bought and used primarily for setting tires on wooden wheels) where it is forced to size and made practically a true circle. This operation is completed in less than five minutes.

The next operation consists in punching the holes for the spokes, which is done in the machine shown in Fig. 1. It will be noticed by Fig. 3 that the holes are tapered. This taper is obtained by using a die with a hole of the same diameter as the large end of the hole; the punch being the same as the small end of the hole; or, perhaps, to make my meaning clearer, we use a die as much larger than the punch as the taper desired plus the clearance usually used with punches and dies.

The rim is first placed in the machine as shown by the dotted lines XX, and as the holes are staggered, the spacer (not shown) is set for one-half of the total number of holes required, and, to complete the operation, the rim is turned over to punch the other half. The spokes are cut the proper length, alowance being made for material to form the collar shown. This is done in an ordinary bolt-header, the other end being flattened by a blow from a small trip hammer.

The spokes and rim are now ready to go to the riveter,

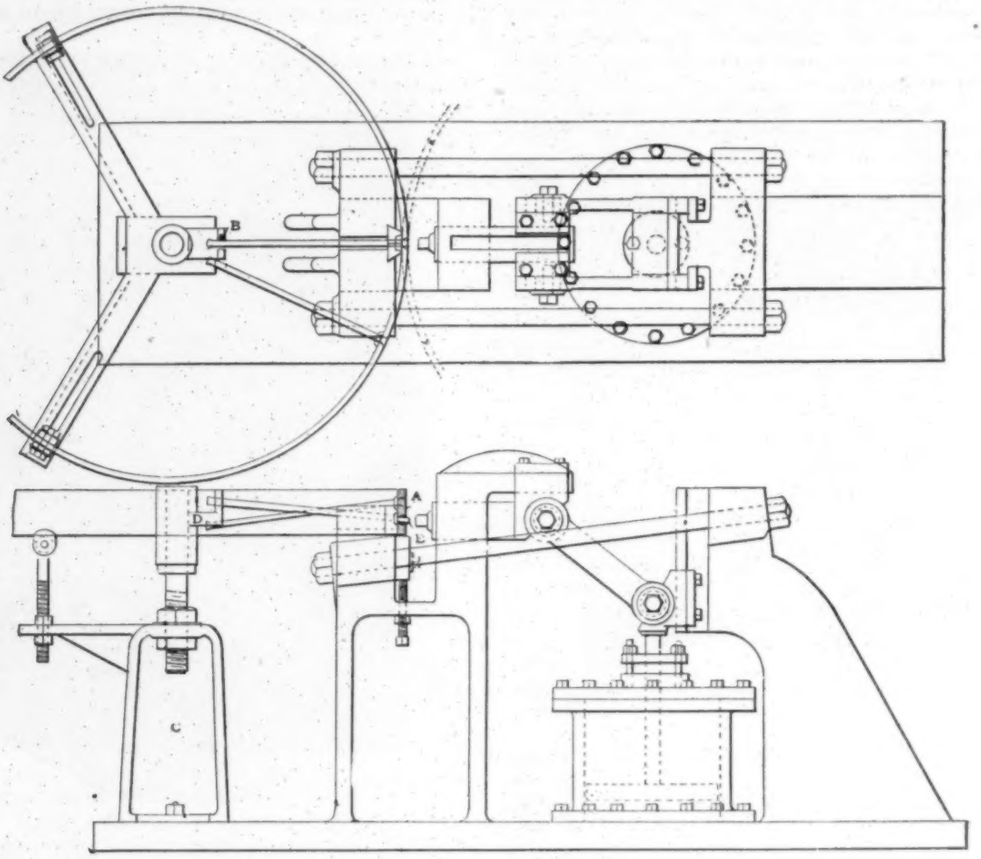

FIG. 1.—PLAN AND ELEVATION OF PUNCHING AND RIVETING MACHINE FOR STEEL WHEELS.

This machine is supplied with a stand C, on which is mounted a casting D, which is slotted, as shown, at B. This slot receives the spoke and holds it in proper position for riveting. A wheel rim is shown in place, with spoke A riveted and B in position. The ram of the machine is supplied with a flat end punch of considerably larger diameter than the hole in the rim. A heating furnace is placed convenient to the operator. Suspended over the center of the rim is an air lift. The die for receiving the spoke is split and connected, as shown at Fig. 4, by a steel spring (not shown on Fig. 1). This spring is used to enable the operator to handle the die easily and to open it automatically when the rim with the riveted spoke is lifted to be turned round to secure another spoke. After every alternate spoke is thus riveted the rim is turned over and the operation is finished. The die has a cavity for receiving the collar on the spoke, keeping it in good shape while the end is forced to fill the taper hole.

This method of connecting the rim and spoke is, I think, the best that can be devised. The rim and spokes thus put

together are shown by Fig. 2 as they appear when ready to receive the hub. In the operation of riveting the spokes into the rim, the workman takes a spoke from the furnace with his left hand, holding the die in his right. Closing it

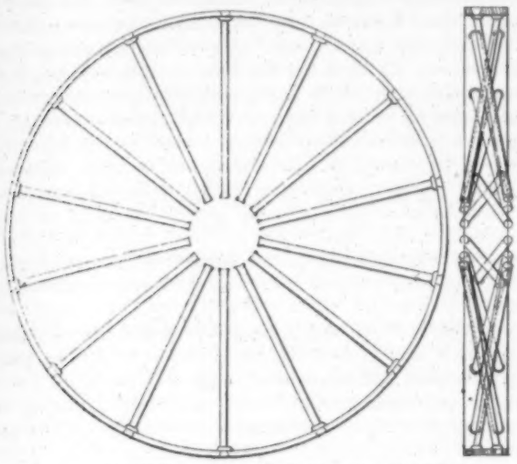

FIG. 2.—WHEEL WITH SPOKES RIVETED IN THE RIM.

over the spoke, he places the other end of the spoke in the slot of the false hub at the same time placing the die in position. After releasing it, he adjusts the rim in position, so that the spoke will enter the hole, holding the spoke firmly in

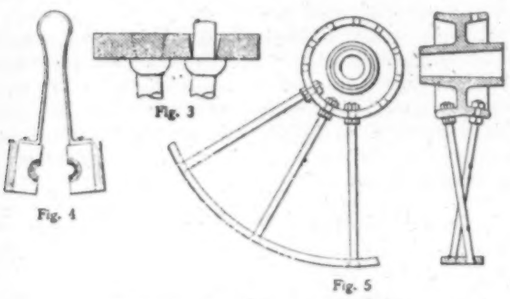

Fig. 3

Fig. 4

Fig. 5

DETAILS IN MAKING STEEL WHEELS.

the slot of the false hub with the left hand and operating the valve with his right. The valve and lever are not shown. The piston may be operated with steam or compressed air. In this case air was used.

Pittsburg Foundrymen's Association.

The regular monthly meeting of the Pittsburg Foundrymen's Association held Wednesday evening, Jan. 2, was not very well attended, many of the members being absent from the city owing to the holidays. For the first time in many months there was no paper for discussion, not because none was prepared, but on account of a slight delay caused by the printers.

At the business session it was reported that the New England Society had replied to the letter sent to all the local associations notifying them of the recent action of the Pittsburg local whereby all the members joined the national body. The matter has not yet been considered by the New England association, but definite action will be taken at the next meeting, according to the reply.

The following letter was received from Mr. H. H. Hooker and read: "Through the generosity of Mr. Andrew Carnegie, Pittsburg is soon to have a technical institute, or trade school, which it can be safely assumed will be second to none. The mere fact that Mr. Carnegie is its founder is sufficient evidence of that, aside from the vastness of Pittsburg as an industrial center, in which such an institution will for all time command the greatest interest. In other technical institutions, trade schools, and the like, the important instruction in foundry practice and foundry methods is not given sufficient if any attention. The members of the Pittsburg Foundrymen's Association will at once appreciate this, and it would seem to me that an opportunity now presents itself for our association to further this object. It is my suggestion that the trustees of the new institute be approached, either by resolution suitably engrossed or by personal visit of a committee with reference to giving such instruction a place in its curriculum."

Mr. Hooker's suggestion was well received and was followed by some discussion before action was taken. It was stated that while partial courses in foundry practice are given in some of the technical schools of the country none of them take the study up as fully as they should. A committee consisting of J. S. Seaman, F. H. Zimmers and D. P. Thomas was appointed to confer with the trustees of the institute and report at the next meeting.

OUTPUT OF BLAST FURNACES OF UNITED STATES.*

January 1, 1901.

Location of Furnaces.	Coke and Anthracite.					Charcoal.				
	Total No. of Stacks.	In Blast.		Out of Blast.		Total No. of Stacks.	In Blast.		Out of Blast.	
		Number.	Weekly capacity.	Number.	Weekly capacity.		Number.	Weekly capacity.	Number.	Weekly capacity.
New York	24	2	3059	12	8857	2	2	194	0	0
New Jersey	8	2	1321	6	3281	.....	.....	.....	.....	.....
Spiegel	3	3	585	0	0	.....	.....	.....	.....	.....
Pennsylvania:						13	2	123	11	500
Lehigh Valley	29	16	9820	13	5064	.....	.....	.....	.....	.....
Spiegel	1	1	111	0	0	.....	.....	.....	.....	.....
Schuylkill Valley	14	9	8182	5	2115	.....	.....	.....	.....	.....
Upper Susqu. Val.	4	3	3567	1	336	.....	.....	.....	.....	.....
Lower Susqu. Val.	9	3	3670	6	2586	.....	.....	.....	.....	.....
Spiegel	1	1	510	0	0	.....	.....	.....	.....	.....
Lebanon Valley	13	10	8923	3	2360	.....	.....	.....	.....	.....
Pittsburgh Dis't.	30	26	57860	4	6486	.....	.....	.....	.....	.....
Spiegel	1	1	1115	0	0	.....	.....	.....	.....	.....
Shenango Valley	15	8	12220	7	6603	.....	.....	.....	.....	.....
West'n Pennsylvania	22	10	14455	12	7498	.....	.....	.....	.....	.....
Spiegel	1	1	457	0	0	.....	.....	.....	.....	.....
Maryland	5	3	5712	2	1375	4	1	102	3	340
Spiegel	1	1	403	0	0	.....	.....	.....	.....	.....
Wheeling District	8	5	7714	3	4095	.....	.....	.....	.....	.....
Ohio:						6	5	310	1	80
Mahoning Valley	14	9	19392	5		.....	.....	.....	.....	.....
Central & Northern	14	10	15075	4		.....	.....	.....	.....	.....
Hocking Valley	2	2	809	0	0	.....	.....	.....	.....	.....
Hanging Rock	14	7	3554	7	2810	.....	.....	.....	.....	.....
Illinois	16	12	23340	4	4549	.....	.....	.....	.....	.....
Spiegel	1	1	850	0	0	.....	.....	.....	.....	.....
Wisconsin & Minnesota	6	3	3557	3	1939	.....	.....	.....	.....	.....
Missouri	1	0	0	1	570	.....	.....	.....	.....	.....
Colorado	2	2	2008	0	0	.....	.....	.....	.....	.....
Virginia	20	16	9299	4	2260	3	2	103	1	80
Kentucky	5	2	667	3	1720	3	0	0	3	200
Alabama	38	25	19585	13	7934	4	3	1014	1	325
Mich., Mo. and Wis.	.....	.....	.....	.....	.....	13	8	3293	5	2395
Tennessee	14	8	5748	6	2827	5	3	1168	2	320
Georgia	1	0	0	1	450	4	2	585	2	330
North Carolina	2	0	0	2	437	.....	.....	.....	.....	.....
New England	.....	.....	.....	.....	.....	7	3	285	4	360
Texas	.....	.....	.....	.....	.....	4	1	120	3	775
Utah	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oregon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	328	201	243254	127	91496	68	32	7097	36	5705

SUMMARY.

Fuel.	In Blast.						Out of Blast.			
	Number.			Weekly Capacity.			Number.		Weekly Capacity.	
		Month Previous.	Year Previous.		Month Previous.	Year Previous.		Month Previous.		Month Previous.
Charcoal	32	32	30	7,097	6,779	7,457	36	38	5,705	6,153
Coke and Anthracite	201	179	259	243,254	222,067	286,729	127	147	91,496	107,761
Total	233	211	289	250,351	228,846	294,186	163	185	97,201	113,914

*Condensed from the *Iron Age*. The decrease of unsold stocks, so far as these are reported, was from 556,636 tons Dec. 1 to 548,663 tons Jan. 1, or about 8,000 tons.

Statistics of the iron, steel and machinery trade of Milwaukee, Wis., show 36 plants, employing a capital of $9,642,600, and turning out during the past year products amounting in value to $21,874,670. The number of men employed is 6,156, to whom wages amounting to $4,218,345 were paid during 1900.

The *World's Work* for January under "Great Tasks of the New Century," describes a number of revolutionary movements of certain governments and corporations, whose completion will change routes of travel and the direction of civilization.

ARBITRATION IN THE FOUNDRY TRADE.

One of the most interesting and practically valuable papers read at the recent arbitration convention at Chicago, under the auspices of the National Civic Federation, was that of President Martin Fox, of the Iron Molders' Union, on "Arbitration and Conciliation in Labor Disputes." It is given up largely to a history of the relations between the Iron Molders' Union and the Stove Founders' National Defense Association and later the National Founders' Association. We reproduce the greater portion of it as of present interest to foundrymen and others.

Arbitration with Stove Founders.

The Iron Molders' Union, which I have the honor to represent as its president, has had its full experience of strikes since its organization in 1859. In 1886 a new element was interjected into the industrial warfare which it had ceaselessly waged. It was in the stove manufacturing branch of the iron molding trade. Learning, no doubt, the lesson the workman had learned—that in combination they possessed greater power of offense or defense than when they acted in their individual capacity—the stove manufacturers, who had for some years, been associated for the purpose of discussing matters of general interest to the industry, formed what is known as the Stove Founders' National Defense Association. In the year 1887, that association and the Iron Molders' Union of North America first clashed. The struggle was a bitter one, and, while at its conclusion neither side could claim a decisive victory, it left each with a better appreciation of the other's power, and emphasized the disastrous results that might be expected to ensue from a series of conflicts between such powerful associations. The active spirits of both finally met in conference, in 1891, and the result was the foundation of what I believe to be the first agreement in this country which provided for the application of the principles of voluntary arbitration—or perhaps it might be better named, voluntary conciliation—in dispute, arising between members of an employers' association and members of a trade-union. This agreement simply recited general principles and provided means for their practical application to trade problems as they were known to exist by the representatives of the two associations. The following extract from that first agreement will place the matter more clearly before you:

"*Resolved*, That this meeting adopt the principle of arbitration in the settlement of any dispute between the members of the I. M. U. of N. A. and the members of the S. F. N. D. A.;

That a conference committee be formed, consisting of six members, three of whom shall be stove molders appointed by the Iron Molders' Union of North America, and three persons appointed by the S. F. N. D. A., all to hold their offices from May 1 to April 30 of each year. Whenever there is a dispute between a member of the S. F. N. D. A. and the molders in his employ, and it cannot be settled amicably between them, it shall be referred to the presidents of the two associations before named, who shall themselves or by delegates give it due consideration. If they cannot decide it satisfactorily to themselves, they may, by mutual agreement, summon the conference committee, to whom the dispute shall be referred, and whose decision by a majority vote shall be final and binding upon each party for the term of twelve months. Pending adjudication by the presidents and conference committee, neither party to the dispute shall discontinue operations, but shall proceed with business in the ordinary manner."

The wage rate, being the most prolific source of friction, was the one most carefully provided for. There were other matters, affecting shop management and conditions, upon which at this time no agreement was possible, and it was wisely determined to allow time, and the education which must result from annual contact and conference, to bring its influence to bear, before attempting to secure an understanding upon them.

It gives me pleasure to say—and the members of this National Civic Federation will agree that it is a striking proof of the success of the application of a policy of conciliation in the stove manufacturing industry—that since the 1891 agreement was ratified there has been no conflict between members of the two associations, and no dispute that has arisen has refused to yield to the application of its provisions.

Results in the Stove Trade.

While this was the first practical application of the principles of arbitration to disputes arising in any branch of our trade, I might add that as early as 1876 a referendum vote of the membership of the Iron Molders' Union had declared in favor of the arbitration of trade disputes, but had not been able to successfully put this policy in operation, because there was no association of employers with whom to enter into such a contract. When a dispute arose between a stove manufacturer and his men, and negotiations between their immediate representatives failed, there was at once an open rupture, and, when that has occurred, it is difficult, indeed, to arbitrate. In the agreement to which I have referred, cognizance was taken of that fact, and one of its clauses provided that the members of neither association should be governed by their impulses, but—and I desire to emphasize the point—should remain at work pending investigation by the proper officers of the two associations.

From my experience with this successful attempt at conciliation and arbitration of industrial differences, I am led to deduce:

First—That both the employing and employed interests must be organized into associations which subscribe to the principle that capital and labor have an equal voice in the fixing of wages and conditions of labor, before the principles of conciliation or voluntary arbitration can be successfully applied.

Second—The more thorough that organization, on both sides, the better the ultimate results.

Third—Work should continue without interruption, pending arbitration.

Fourth—That, inasmuch as it is only through the existence of an organization of the workingmen interested that arbitration can be successfully undertaken, employers should encourage their growth and extension.

Fifth—That when the dispute arises over some technical detail of a trade upon which there has been no general agreement on the part of the associations of employers and workmen, a conciliatory policy should be pursued by both parties, and an effort made to settle by common-sense methods, with a due regard to the custom and precedent of the locality in which the dispute arises.

The "New York Agreement."

Our success in applying the principles of voluntary arbitration in disputes arising in the stove trade inclined us to view with some gratification the tendency of the foundrymen in other branches of the trade to form an association on the same lines as the Stove Founders' National Defense Association. And, when the National Founders' Association was finally launched on its career, I, as president of the Iron Molders' Union, made advances, with a view to consummating an agreement, such as we already had in the stove trade. These advances were met in a friendly spirit, and in March, 1899, representatives of the two associations met in New York, and ratified the following agreement, since known as the "New York Agreement:"

"WHEREAS, The experience of the members of the National Founders' Association and the Iron Molders' Union of North America justifies them in the opinion that any arrangement entered into that will conduce to the greater harmony of their relations as employers and employees will be to their mutual advantage; therefore, be it

Resolved, That this committee of conference endorse the principle of arbitration in the settlement of trade disputes, and recommend the same for adoption by the members of the National Founders' Association and the Iron Molders' Union of North America on the following lines:

That in the event of a dispute arising between members of the respective organizations, a reasonable effort shall be made by the parties directly at interest to effect a satisfactory adjustment of the difficulty; failing to do which, either party shall have the right to ask its reference to a committee of arbitration, which shall consist of the presidents of the N. F. A. and the I. M. U. of N. A., or their representatives, and two other representatives from each association appointed by the respective presidents. The finding of this committee of arbitration by majority vote shall be considered final, in so far as the future action of the respective organizations is concerned. Pending adjudication by the committee of arbitration, there shall be no cessation of work at the instance of either party to the dispute. The committee of arbitration shall meet within two weeks after reference of the dispute to them."

This agreement, it will be seen, did not go any further than to recite the faith of each party in the principle of conciliation and arbitration ,and provide the necessary machinery through which to give it practical effect. No attempt was made to

effect an understanding upon matters of technical detail. That was considered a wise policy, for, unlike the stove manufacturers' association, which represented only those who were engaged in the same industry, the National Founders' Association practically admitted to membership any foundryman who was not a member of the other association. Thus it had a composite membership, representing foundries whose methods and necessities were not identical, and it would be extremely difficult, under these circumstances, to formulate agreements of a general character, capable of meeting all exigencies which might arise in the shops of a membership of such a varied character.

Friction Between N. F. A. and I. M. U.

For a time, the two associations confined their efforts to a consideration of wage disputes, and were fairly successful, although one serious weakness was early detected, in the disposition of a number of the members of the National Founders' Association to refuse recognition to the trade union of their molders. That recognition, as I have previously shown, is, next to the fact of an organization of the two interests, one of the chief requisites to the success of the principles we had subscribed to. Later on, attempts were made by representatives of the National Founders' Association and the Iron Molders' Union, in conference, to come to an understanding upon questions vitally affecting the interests of both parties in matters of shop practice and conditions of labor, and, in the opinion of the union representatives, vitally affecting the integrity of their organization, but were unsuccessful and led to the most strained relations between the two associations, which culminated, later, in an open rupture in an important section of the joint jurisdiction. It is true the New York Agreement is still operative in other sections of the jurisdiction, but it can well be understood that, with each association bending its every effort to defeat the other in the city of Cleveland, O., the principles of arbitration, to which each has subscribed, cannot be applied as effectively as they could if a more happy state of affairs existed.

It would not advance the purposes of this conference to go into details of these points of serious difference between the two associations, but, in order to demonstrate what I consider another essential factor to the success of voluntary arbitration, I will simply state that one of the provisions of the resolutions to which the representatives of the Iron Molders' Union were asked to subscribe, was such as would, in its operation, seriously affect its prestige, and its ability to enforce discipline among its members and preserve its integrity. At least, that was and is the opinion of the thinking element of that union and as can well be understood was destructive of confidence in the purposes of the employers' association. Confidence in the honesty of purpose of each party is without doubt an essential factor to the success of arbitration of trade disputes. Destroy it—or even arouse a suspicion—and the effectiveness of any policy of arbitration is seriously endangered.

Here then we have two examples of attempts at voluntary arbitration of trade disputes in the foundry industry—one, successful; the other, partially unsuccessful. A comparison of the policies pursued in each case will assist the students of the industrial problem to conceive the dangers which threaten the success of all policies involving arbitration, and will show by practical demonstration more clearly than I can do in words that unless the last remnant of that antagonism which existed between the employer and the employee in the earlier days of our industrial development be removed and employers and employers' associations give organizations of labor (which alone can assist them in the successful application of the principles of voluntary arbitration in industrial disputes) the fullest recognition and encouragement, we can never hope to see the fullest success of its beneficent principles. It may be thought that these sentiments are the sentiments of a trade-unionist. They are—and as such are the sentiments of a class of men who have given the subject a longer and more interested consideration than any other class of the community. They are not entirely selfish in their character, but are the deductions of long experience and earnest thought in the labor movement.

Before proceeding to the consideration of compulsory arbitration, permit me to point out that, under a system of conciliation or voluntary arbitration such as I have outlined, it is made mandatory that the parties immediately interested in any dispute make an earnest effort to settle, themselves, before referring it to outsiders. It is true, the mere existence of an agreement which provides for the arbitration of disputes in any trade, has a tendency to lessen the seriousness of the effort made by the original disputants to settle, because they know that failure to agree does not immediately involve them in a strike. This is a regrettable feature, but is after all only primary in its character, and when it is found after a few experiences that as good terms can be secured by their own efforts as can be secured as a rule by arbitration, only the more serious disputes will find their way to the arbitrators, who under this system are always practical men, thoroughly conversant with the subjects which are likely to be brought to their consideration.

It might not be amiss at this stage to say that in the event of an industry coming under the control of one immense corporation, and each branch or plant thereof being simply the part of one great whole, it would be an almost impossible proposition to operate successfully under such an agreement as that already quoted. It would no longer be possible to secure a committee of disinterested employers, thoroughly conversant with the industry and identified with it, to act on the board of conciliation or arbitration, and this is one of the strong features of the arrangement under discussion. We cannot arbitrate in this way with a trust controlling the entire industry, although we might with a number of smaller combinations controlling the industry in different sections of the country. In such an emergency, if the principles of arbitration are to govern, I incline to the belief that the state or national government would have to provide the necessary machinery.

Cumpulsory Arbitration Opposed.

Having dwelt at some length, already, upon practical examples of the operation of a system of voluntary arbitration in the iron molding industry, I will be brief in my remarks upon compulsory arbitration. It will have been gathered from my utterances that I am a strong adherent of the voluntary system. Organized labor never assumes the position "there is nothing to arbitrate," and it requires no compulsory law to induce it to submit its case to a tribunal competent to adjudicate upon it, when its plea involves one of wages or conditions.

There is something about the idea of compulsion that is repugnant to American conceptions of liberty of action, and it is not difficult to conceive a case in which workingmen would be compelled to work under conditions, or for wages, that were obnoxious to them. I recognize, of course, that were it possible always to guarantee a tribunal to adjudicate upon a dispute, which could and would do full justice to all interests, compulsion both in arbitrating and in enforcing the award could be justified. We know, however, that among men as at present constituted, such a guarantee is impossible. We know, also, that there is not a perfect community of understanding among the classes, upon what is called the labor problem. That being the case, it would be an extremely difficult matter to constitute a court of arbitration which would have the entire confidence of the interests involved, and hence, to secure a court whose finding would give satisfaction. I am strongly of the conviction that, in a country like the United States, where there are so many diverse interests, so many diverse views, and so many instances in which the interests of capital are placed before those of labor, compulsory arbitration is thoroughly impractical, and its principle is thoroughly obnoxious to the American citizen. The citizen cannot afford to lend his assent to any governmental institution which, in the capacity of a court having power to enforce its award, could compel him to submit to conditions of labor which are obnoxious to him, under penalty of fine or loss of liberty. Especially is it objectionable, when, in a system of voluntary arbitration, such as has been outlined in this paper, there is as yet ample provision, both for the preservation of industrial peace, and the dispensation of justice in industrial disputes.

I would not be consistent, after having assumed this attitude to compulsory arbitration in general industrial enterprises, were I to endorse its application in disputes of those engaged in enterprises of a quasi-public character, such as steam or street railways. I am willing to admit that, inasmuch as the

public are more deeply interested in this instance, and are often grievously inconvenienced by reason of disputes arising between the employees and the management engaged in the operation of enterprises of this character, there is more justification for such governmental interference as would be involved in this limited form of compulsory arbitration, but I feel that, even under these circumstances, I would not be justified in prescribing for the employees of a street railroad, or other public carrier, a process to which I objected myself. It will be seen that in all my references to compulsory arbitration I assume that the board or court of arbitration would be vested with the power necessary to enforce its award; that is, to punish its violation, by fine or imprisonment. And I can conceive of no such board or court proving effective unless it be vested with such powers. Then, again, if the New Zealand law be followed, the referee or odd man in the board, would likely be a member of the judiciary, and, as he could not always be expected to possess an intimate knowledge of the varied interests he would be called upon to decide, these interests would be in some danger of suffering injustice, such as would not be the case were the voluntary system in operation.

UNIFORMITY IN MINING MACHINERY.

One of the papers read before the 1900 meeting of the Lake Superior Mining Institute, which was held on the Menominee range, was by Charles H. Fitch, of Fraser & Chalmers, Chicago, on "Economy in the Manufacture of Mining Machinery." It appeared in these columns at the time. The proceedings of the Institute recently published contain the discussion on Mr. Fitch's paper, which was participated in by a number of leading mine managers of the Lake Superior region. Something of the trend of the paper may be gathered from the concluding paragraph, which was made the text of the discussion. It was as follows: "If the first cost of what is best is now formidable it is largely due to the improvidence of the mining man. Let him essay the task of specifying the best, and making his specifications standard. Then the manufacturing effort now spent in catering to meaningless and uneconomical variations will be confined to more uniform lines. Manufacturers can and will then produce the best at much less cost than now for two reasons: 1. There will be removed an element of uncertainty in the selling, which now greatly increases prices. 2. The problem of shop work will be presented in its most advantageous economic form, namely: The repeated production of one kind of work to which a man can give his undistracted attention until it is unerringly accomplished in the best way." The comments of members of the Institute follow:

Mr. Kelly—As the depth and size of mining operations increase, their success depends more and more on the solution of the mechanical problems that arise and the subject of the paper that has just been presented is of very great importance. The majority of the members of the Institute are best acquainted with the uses of mining machinery so that this paper is of special interest to them because of its point of view. In many cases the purchaser looks to the manufacturer as an adviser with special and broader experience and the latter is in some measure responsible for the selection of the design and the rejection of what is unsuitable and antiquated. That this responsibility is appreciated is illustrated by an incident in the speaker's experience. A heavy pressure pump of large capacity was required and the agent of the manufacturer quoted a price on a triple expansion pump to meet the conditions of capacity, lift, steam pressure, etc. Triple expansion mine pumps had not been long tried, the steam pressure was not very high and a price on a compound pump was asked for. But the agent replied, "I will not make you a price on a compound pump; I cannot recommend it for the conditions. The economy of a triple pump will not permit you to buy a compound pump." The advice was accepted and the service of the triple pump shows its wisdom. It is evidently not for the interest of either party and it can hardly be said to be customary, for the purchaser to prescribe detailed specifications without consultation with the manufacturer.

Mr. Hood—I notice that the author names at least two methods of reducing the cost of machinery, one on his side of the fence and one on ours. He speaks first of economies in the foundry, of which I know something. There is no part of machinery where the product is liable to such variations as in the foundry. The difficulty of retaining the best men in this line of work is the reason for much inferior foundry practice. As to the other question, that of having the members of this Institute select and specify that which is best, I am of the opinion that there would be a great deal of difficulty in getting together on a good many of the most important lines. Asking one member as to his opinion of the construction of a certain connecting rod, he condemned it, and the next gentleman asked could not praise it too highly. Each had long experience. Where the conditions vary so widely it seems to me difficult to get together on very many lines.

Mr. Channing—I fear that too much uniformity in the design of mining machinery would tend to retard improvement. There is more individuality in the design of an air compressor than in that of an angle bar. It is easy to make a trust out of the manufacturers of structural material while it would be impossible to bring under one head the makers of mining machinery. The air compressor of ten years ago is to-day an inefficient machine and the improvements have come not so much from the manufacturer's desire to change his patterns as from the demand of the mining engineer that a higher speed and consequently smaller and cheaper machine shall be furnished him which shall at the same time show greater efficiency. The usual data furnished the manufacturer simply demand so many cubic feet of free air per minute under certain conditions of altitude and steam pressure. It is for him to submit his design, price and guarantee of economy. If he sticks to a standard design he may find a competitor taking the order.

While we may have standard sizes for compressors, as the air pressure, at least in mining work, varies between small limits and the steam cylinders need but vary according to the boiler pressure; yet, in hoisting engines there are so many variables that as long as ore deposits vary in their dimensions and character, fuel in its bulk and price, water in its solid constituents and abundance and labor in the efficiency, so long must the design of a hoisting engine vary. No doubt certain sizes and types of drum might be adopted and these in combination with various standard cylinders might aid the economy of manufacture. I lately asked for bids on three blowing engines to be used in furnishing blast for three copper smelting blast furnaces. The pressure, two and a half pounds to the square inch, was lower than is usual in blowing engines and I was obliged to decline the proposals of those firms who offered me an engine whose blowing tubes were mere duplicates of those acceptable for higher pressures. For small hoisters and for most kinds of pumps I think we have adopted standards but for larger machines there is a constant demand for individuality and the designer of genius is bound to break away from standards and preconceived notions.

Mr. McKee—I think it would be very difficult to standardize mining machinery. With pumps the best that could be done would probably be to make steam ends of certain powers and water ends of certain capacities so designated that they may be interchanged. It is impossible to make the pumps of uniform size, as it is not possible to regulate the amount of water made by a mine or the height to which it is to be lifted. As to boilers, those now built by reputable builders (and no others should be bought) conform pretty closely, or should, to Hartford standard specifications. I would suggest that, as these specifications are so easily obtained, that they be secured and used where new boilers ought to be purchased. As to hoisting machinery, it would probably be easier to standardize than almost anything else. But even this would be very difficult under present conditions. At present no two mines carry the same steam pressure or hoist the same load at the same velocity. The mine managements might get together and adopt some standard sizes of skips, but at present you will see all dimensions of skips from about one to five tons. Here again, however, we meet the difficulty of mines of variable depths and conditions requiring hoisting at widely varying speeds. I think on the whole that it would be quite difficult to standardize the machinery at all.

Mr. Pope—I think the manufacturer of machinery does not usually consider the fact that a mining manager is very seldom able to equip his plant in a way he would like to equip it, or that he cannot tell at any time what he is going to want in the future. He is answerable always to the home office, the execu-

tive of which is usually unacquainted with mining problems and sometimes thinks he is doing great work for the company by opposing the suggestions of the manager, who is compelled to go to as little expense as possible, and if too enterprising may be removed from his position. The manager cannot disclose to the manufacturer his reasons for not buying a plant which would be needed for an assured future, and therefore the manufacturer finds fault with him, says he does not know what he wants, and blames him for not doing what he is not allowed to do. I do not think the manager should be obliged to furnish all the details of the machinery. He can give the steam pressure, speed of hoist, depth of shaft, and many other essentials which he has learned the need of in his experience and then ask for details and specifications from the manufacturer for consideration—because no two mining propositions are alike, and the manager must adopt such machinery as his conditions require.

Mr. Davidson—I think Mr. Pope's ideas of the subject are correct. The equipment of a mine cannot be determined in advance as the equipment of a factory can be, but in most cases a mine superintendent must add to his machinery as his property is developed. As a result, we often see mines equipped with machinery that is not by any means the most desirable or economical, but before one is justified in throwing it out he must be quite sure that he has ore enough in sight to warrant the cost of purchase and installation of new machinery.

Mr. Fitch—Of course engineering conditions which determine approximate sizes and capacities cannot be ignored, and mining problems must often be attacked with limited resources. Still the work of design may be approached on broader lines reaching an improved system of graded sizes, both in entire machines and in their elements. Taking the whole common stock of mining equipment the differences of design in machinery for like uses are largely unessential. To that extent they may be eliminated with manifest economy in manufacture, repair and use. Also with every agreement upon a unit such as suggested by Mr. Channing in the matter of skip sizes, the elements of necessary variation are reduced to a more manageable series. Most first designs are at fault in simplicity, and a very large machine attacked as a problem by itself is a first design, usually an expensive monument with needless efforts of invention. A good course is to design broadly for a series of sizes at once. Some years ago I was being shown through the Baldwin Locomotive Works by the late Dr. Williams and expressed surprise at the great variety in styles and sizes of engines which they built. He said: "You would be more surprised at the small number of patterns from which we build them." The Baldwin people not only build more engines than any other works but they are of the finest types, and are built for quick delivery, and require only one-half to one-third the hours of manual labor needed for similar work in large foreign shops. The reason is simple. They put brains into their business and standardize their work in every detail. This is perfectly practicable, but too sparingly practiced in our mining machinery shops.

Steel Plate Exports to the Clyde.

Various estimates have appeared of the tonnage of steel plates sold by American manufacturers to shipbuilders on the Clyde. The following appears in one of the English iron trade papers in its comment on the steel plate industry: "The condition of this branch of the steel trade is far from satisfactory, despite the fact that there is still a large demand for shipbuilding materials, and a great volume of work is on hand in our shipyards. Prices have had to be reduced to such a point that it is difficult to make profits. It is understood that a large quantity of American plates have been sold to arrive, but it cannot be accurately stated how much iron and steel has actually arrived from the United States, because a good deal of it has come *via* Antwerp, Rotterdam, and Hamburg, and is entered at the Custom House as from these ports. Glasgow estimates are said to be that from 150,000 to 200,000 tons of shipbuilding material have been sold on American account to Clyde shipbuilders for present and forward delivery. It is also reported that quotations have been made in America equal to only £6 per ton delivered over here. Hence British shipplate manufacturers have been forced to reduce their prices to £6 10s., and as they still require to pay about £3 15s. for hematite pig iron, and 12s. to 14s. per ton for coal, with unusually high labor costs, it is evident that their 'lot is not a happy one.'"

MR. CARNEGIE ON THE NEW TUBE WORKS.

Immediately following the Carnegie Co. announcement of the location of a tube plant at Conneaut Harbor, O., rumors were set afloat throwing some doubt on the sincerity of the company's intention to carry out the announced plans. In the iron trade there was an attempt to find a reason for the location of the plant at Conneaut rather than in the Pittsburg district. Regarding the reasons for going outside of the Pittsburg district Andrew Carnegie was quoted last week as follows:

"In the first place I am bound to say that Conneaut was not considered until the Pennsylvania railroad without consulting, doubled our export rates. We had bought ground on the Monongahela river, but could not get title. Afterward, as President Schwab says, we tried to get a location on the Allegheny river. Then came the blow without warning from the Pennsylvania railroad, the doubling of rates, which led our people to take up the question: 'How can we escape from the grasp of this arbitrary railroad combination?'

"A study of the subject convinced every one that we could do so by taking to water. When I returned from Europe it was to find all agreed that this was the best method of relief. Whether we would have tried to adapt our works to the Allegheny site or not, had these rates not been advanced, of course, I cannot tell, because there was more than one advantage in going to Conneaut.

"But let Pittsburg note this: If it had not been for our own Bessemer railroad, Pittsburg would have been the best site for the new works. The concerns on the lake have to pay $1.25 a ton for coke and about 75 cents a ton for coal, which is more than the cost of bringing ore from the lakes to Pittsburg. With us, however, it is entirely different. We save bringing the ore to Pittsburg, and the shipping of coal and coke north costs nothing, as we have plenty of empty cars. So, I reply to an editorial recently published, that I adhere to my expressed opinion that Pittsburg is the best place for steel manufacturers. I have not changed my mind in that, provided always that manufacturing concerns located along the Pittsburg railroads can get the same rates per ton as those in Chicago or Alabama.

"I have been asked whether additional works planned by the Carnegie Steel Co. will go to Conneaut. I hope not. It took a long time to get my own approval of putting even the tube works there, and, to show my faith in Pittsburg, when the Carnegie Co. decided not to exercise its option on 513 acres on the Allegheny river, I purchased the property myself and I expect to see manufacturing concerns upon it soon. That does not look as if I had lost faith in or affection for Pittsburg. Our establishment at Conneaut will benefit Pittsburg because we shall give the Pittsburg railroads an object lesson. A very small proportion of our freight will go by rail from these works. We are already in the shipping business and have only to add half a dozen small steamers to our fleet to ply to the important lake cities, distributing steel and loading up with scrap, of which we shall use an enormous quantity. I go on record as saying that Pittsburg will enjoy lower freight rates than it has ever done before.

"Every shipper, from the man who sends a carload to the man who sends a train, will enjoy these rates. Rates will be open—no secret rebates or private understandings—but all fair and on an equality. As far as the Carnegie Steel Co. is concerned I have to say for its owners that it does not seek anything which its brother manufacturers in Pittsburg do not get for the same service. Our competitors are not in Pittsburg, but in other districts.

"I had an interview with President Cassatt yesterday. He assures me that his policy is to protect the manufacturers on his line. He says that he will give them lower rates later than he is about to fix, if other districts continue to do so for the same articles. Further, I am delighted to say that President Cassatt volunteered the statement that he had told the members of his board that when the immense new works of the Scranton company at Buffalo began operations they must be prepared to give very low rates to the seaboard. He also said that low rates to the West were necessary, as Pittsburg products have to pay the freight into other competing districts."

Asked whether the proposed plant was supposed to be a

blow at the National Tube Co., Mr. Carnegie replied that at one time the original National company purchased billets from his company, but later decided to erect its own blast furnaces and to make its own billets. Continuing he said, "As I understand the policy of the Carnegie Steel Co., it is to co-operate in every way with its fellow-manufacturers in the industrial world and not to push itself into any new field save in self-defense. We did not leave the National Tube Co. They left us, which they had a perfect right to do, of course. Now we are ready to shake hands and co-operate with them in the most friendly spirit. We are better for them than a dozen small concerns, conducted in a small, jealous way. We believe there is room enough for the two concerns. The use of tubing is extending rapidly. Scarcely a house is constructed nowadays that does not use tubing. Besides, we expect to ship a great deal abroad via the Erie and Welland canals. It will not be long before the demand will keep both the National company and ourselves hard pressed to supply."

The Carnegie Steel Co. last week took the first active steps toward the establishment of the tube plant at Conneaut, by securing charters at Columbus, O., for the Conneaut & Eastern railroad and for the Conneaut Land Co. Each corporation has a capital of $10,000 and the incorporators are the same in each instance: E. S. Templeton, John H. Clarke, W. E. Cushing, Frank Leisenheimer and F. B. Carpenter. The route of the new road is from Conneaut to the Pennsylvania State line, where the New York, Chicago & St. Louis, or Nickel Plate, railroad crosses, with a branch northeasterly to the Pennsylvania State line, near Lake Erie.

What the capacity of the new Conneaut plant will be has not yet been officially announced, nor are the plans advanced enough to make an estimate at this time. All estimates made in print in the past week have been mere guesses.

The Allis Company's New Engine Works.

The E. P. Allis Co. will build a new plant at Wauwatosa, Wis. The present works will be consolidated at that point, and five years will be required to complete the buildings and equipment, the investment representing about $2,000,000. Wauwatosa is five miles west of Milwaukee, and a contract has been closed for the purchase at that place of a tract of 100 acres of land, as a site for the proposed works. Edwin Reynolds, general superintendent of the company, has the project in hand. Plans for the building are not fully decided upon, but sketches show a foundry 210 feet wide and 1,000 feet in length, with open space behind for an additional 1,200-foot building. The machine shop, as shown, is 120 feet wide and 600 feet long, and there will be four of these, all of the same dimensions. All will be connected with the erecting shop, 110 feet wide and 1,000 feet long, with sufficient ground behind it to make it whatever length business demands. The entire site under consideration in Wauwatosa covers a length of 2,640 feet, and a width of 1,650 feet. Five railroad tracks run into the shop, each track covered with three traveling cranes. As soon as the buildings can be erected, arrangements for moving from Buffalo will be commenced, but it is thought it will be a year before the works at Buffalo will be closed. There are 500 employes in the Buffalo plant.

The Washburn Wire Co., Worcester, Mass., is erecting open-hearth furnaces at Phillipsdale, East Providence, R. I., which will be put in operation in the spring. The company operates the plant of R. H. Wolff & Co., Ltd., New York City, and the American Electrical Works, at East Providence, adjoining the new plant, manufacturing steel and copper wire respectively. The original capitalization of $1,500,000 has been increased to $3,750,000, $2,500,000 being in 7 per cent preferred, and $1,250,000 in common stock. The first quarterly dividend on the preferred stock was paid Jan. 1.

The Hannah furnace of the Republic Iron & Steel Co., at Youngstown, O., has been relined, and has undergone other improvements. An engine house is building and two Weimer blowing engines will be installed. The furnace will resume on Bessemer about Feb. 1.

The Hall furnace of the Republic Iron & Steel Co., at Sharon, Pa., was blown in Jan. 14.

REDUCTION IN IRON AND STEEL FREIGHTS.

The long promised reduction in freight rates on iron and steel products asked by the producers of the Pittsburg district and the Mahoning and Shenango valleys have been promised at last by the railroads and will become effective on Feb. 1. While no special rate for export purposes has been made a sufficient reduction has been made in the domestic rates, even greater than any of the iron and steel interests ventured to hope for. All of the territory from the Atlantic to the Mississippi and from the Great Lakes to the Ohio river is affected, the rates being reduced proportionately on all iron and steel articles of a list. Articles that have been rated in the fifth class have been relegated to the sixth class according to the request of the iron and steel interests. According to this new rate iron and steel articles from Pittsburg to New York have been reduced from 18 cents to 13 cents per hundred pounds, while the differential between New York and Boston was increased from 2 cents to 3 cents per hundred pounds, and that between New York on one hand and Philadelphia and Baltimore was cut in two.

The Buffalo rates to the East are the same as those from Pittsburg. The customary differentials of the Shenango and Mahoning valleys and Cleveland will prevail on iron and steel shipments to the East. These are 2 cents per 100 pounds to and from the valleys and 3 cents from Cleveland.

The best rate to and from Chicago on iron and steel manufactured articles on full carlots to Pittsburg was made 15 cents per 100 pounds instead of 18 cents, the rate now in force. On less than carlots the base becomes 18 cents per 100 pounds instead of 21 cents, the rate in force. The rate on carlots of iron and steel articles between Chicago and New York either way was made 25 cents per 100 pounds, and on less than carlots 30 cents. The added rates of Pittsburg would make the tariff 28 cents between New York and Chicago. The Eastern and Western rates heretofore have been the same. The charge on billets and pig iron was also reduced. The rate between Pittsburg and Youngstown was made the base, and between these two points the freight on billets was reduced from $1 a ton to 85 cents and on pig iron from 90 cents a ton to 75 cents a ton. The new rates affect every point in the Central district and in the territory east of Pittsburg, where iron and steel is made. The different points are made proportionately lower, the new Cincinnati rate becoming the same as that of Chicago.

A special list of iron and steel articles affected by the new order will be issued so that the schedule can go into effect on February 1. The rate covers all lines of finished crude steel, such as bars, plates, axles, nails, wire, structural material, hoops, rods, bridge material, sheet steel, bands and similar articles The new rate, however, does not include sheet iron, fragile castings, tools, machinery or other articles made out of iron and steel.

Rates from Pittsburg on pig iron and billets, carload lots, follow:

	Pig Iron.	*Billets.*
New York	$2.20	$2.40
Philadelphia	2.00	2.20
Baltimore	1.90	2.10
Boston	2.80	3.00
Chicago	2.50	2.70
East St. Louis	3.10	3.30
Detroit	1.90	2.10
Cincinnati	1.90	2.10
Portsmouth	1.90	2.10
Cleveland	1.15	1.25

The rates on special iron and steel products are as follows:

	Car Lots.	*Less than Car Lots.*
New York	13c	16c
Phiadelphia	12c	15c
Baltimore	11½c	14½c
Boston	16c	19½c
Chicago	15c	18c

From all valley points on pig iron and billets, carload lots:

	Pig Iron.	*Billets.*
New York	$2.60	$2.80
Philadelphia	2.40	2.60
Baltimore	2.30	2.50
Boston	3.20	3.40
Chicago	2.10	2.30
East St. Louis	2.70	2.90
Detroit	1.50	1.70

Cincinnati	1.50	1.70
Portsmouth	1.50	1.70
Cleveland	.75	.85
Pittsburg	.75	.85

The rates on special iron and steel articles as per list, which practically includes about all of the output of valley mills, are as folows:

	Car Lots.	*Less than Car Lots.*
New York	15c	18c
Philadelphia	14c	17c
Baltimore	13½c	16½c
Boston	18c	21½c
Chicago	13c	16c

B. F. Jones, Sr., of Jones & Laughlins, Pittsburg, said in an interview last week, referring to the freight reductions noted above, that they would be of great benefit to the steel interests of Pittsburg. He is thus quoted: "Many a big contract for iron and steel and perhaps other manufactures, has been lost to Pittsburg because competitors, by reason of better transportation rates, could deliver the goods 10 cents a ton cheaper. The reduction granted on seaboard shipments ranges from 70 cents to $1 a ton. The result to Pittsburg and her vast industries must be obvious. I think the benefit will be felt almost immediately. The reduced freight rates will help materially to develop Pittsburg's foreign trade. They will enable us to put our products in Liverpool, or South American ports, or in fact, wherever they are desired, just one dollar a ton cheaper than at present, which obviously means a vast increase in our trade."

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:

The Excelsior Machine Co. of Cohoes, N. Y., has been incorporated with a capital of $16,000. LeRoy Vermilyea, J. H. Neary and J. A. Buck are the incorporators.

The C. E. Rosenbaum Machinery Co. of Little Rock, Ark., has been incorporated with a capital of $50,000 by C. E. Rosenbaum, I. M. Rosenbaum, and H. H. Schmunk.

It is reported that a company with a capital of $50,000 is being formed at New Brighton, Pa., for the manufacture of a track mover invented by D. C. Creese, of New Brighton.

The Morava Construction Co. of Chicago has been incorporated with a capital of $50,000. The new concern will do a general business in general iron and steel construction work. W. Morava, W. H. Foster and B. E. Morse are the incorporators.

The Knutson Machinery Mfg. Co. of Chicago has been incorporated with a capital of $30,000 by T. L. Knutson, Milton Daily and John C. Edwards.

The Hutchinson Machine, Foundry and Mfg. Co. of Hutchinson, Minn., has been incorporated with a capital of $50,000. The new company takes over the plant, business and good will of the Hutchinson Machine-Foundry Co. The plant will be enlarged. The incorporators are Eli Drew, Ernest Schluter, W. E. Harrington and A. H. Buckmaster.

The Ohl Machinery Co. of Newark, N. J., with offices at 28 McWhorter Street, has been incorporated with a capital of $10,000. The new company will buy, sell, manufacture and repair machinery, engines and boilers. The incorporators are C. Ohl, F. L. Buehler and Charles Weigand.

The W. W. Whitehead Co. of Davenport, Ia., has been organized for the purpose of buying and selling second hand and new machinery.

The Campbell & Clute Machinery Co. of Cohoes, N. Y., has been incorporated with a capital of $50,000. John Clute, S. T. Harshaw and F. E. Wilson, all of Cohoes, are the incorporators.

Application has been made for the incorporation of the Atlanta Brick Machinery Co. of Atlanta, Ga. The capital of the company is $25,000, and it will enter the manufacture of all kinds of brick and clay working machinery.

It is reported that L. Acheson of Brazil, Ind., will organize a company to build a rolling mill for the manufacture of merchant bar iron at Chattanooga, Tenn.

The Dawson Mfg. Co., Basic City, Va., is in the market for lathes, milling machines, and all sorts of automobile supplies. The company has bought the Basic City Car Works Co. plant.

John R. Bernard, Fredericksburg, Va., wants a 50 h. p. engine and boiler.

Peacock's Iron Works, Selma, Ala., wants to correspond with manufacturers of pneumatic tools.

John W. White, John W. Welch, James A. Morton, John W. Morton and W. C. Houchin have incorporated the Athens Foundry and Machine Works, Athens, Ga., with capital stock of $15,000, for operating the Athens foundry.

The Phœnix American Pipe Works, Washington, Mo., has been incorporated, with capital stock of $30,000, by Charles Strutz, John Calvin and Marion Strutz.

The Griffith-Powell Co., Norfolk, Va., has been chartered, with capital stock of $5,000, to conduct blacksmith and machine business. Edw. B. Powell is president, and E. J. Griffith secretary and treasurer.

It is reported that a new $100,000 iron plant will be erected at Portsmouth, O. A. B. Voorheis and L. E. Miller, formerly of Voorheis, Miller & Co., Cincinnati, O., are said to be interested.

An independent six-mill tin plate plant will be built at Atlanta, Ind., by a company having Dr. Henry C. Utz as president. The equipment is reported to have been recently purchased at Youngstown, O.

The Nazareth Foundry & Machine Co., Nazareth, Pa., has organized with capital of $15,000. G. A. Schnubell, J. A. Miller, M. T. Schwartz, J. J. Heintzelman, and Conrad Miller are incorporators. A site has been secured and a large building will soon be erected. The company will go into the manufacture of machinery quite extensively.

Fires and Accidents:—

The car shops of the Virginia & Southwestern railroad at Bristol, Tenn., were burned down last week. The loss is estimated at $75,000.

Fire in the wood department of Randell & Co.'s machine shops at Cincinnati, O., did damage to the amount of $2,000 last week.

Knowlton Bros.' iron foundry, Camden, Me., was badly damaged by fire Jan. 8. The loss is $10,000. The plant will be rebuilt at once.

New Construction:—

The Detroit Brass Works, Detroit, Mich., are erecting a two-story addition, 40x100, to cost $5,000

The Schenectady Locomotive Works, Schenectady, N. Y., will erect a new blacksmith shop 40x125 feet.

Henry Sleight and others will erect a new machine shop at Portsmouth, O.

A new foundry and machine shop is being erected on the site of the City Foundry & Machine Works, recently burned, at Bristol, Va. The new plant will cost about $20,000. Major A. S. Reynolds is at the head of the enterprise.

The Midland Steel Co. of Muncie, Ind., will erect a gas pumping station west of the city, near Cammack, Ind. The plant will contain two engines with 500-h. p. capacity each.

The Northwestern Boiler Co. of Duluth will erect a boiler shop to cost about $6,000.

The Passaic Rolling Mill Co. of Paterson, N. J., contemplates making improvements that will cost $200,000. Three gas producers will be installed and five open-hearth furnaces.

Moser Wehrle & Co., of Newark, O., will erect a foundry 348x118 feet.

The Syracuse Stove Works, Syracuse, N. Y., will erect a foundry 50x100 feet to cost about $12,000.

The Richmond Stove Co., Richmond, Va., has purchased additional property for enlarging its foundry.

McDowell & Co., Pittsburg, will erect a $50,000 machine shop as soon as a site can be secured.

The B. & O. shops, Glenwood, Pa., will be enlarged in the spring.

It is announced that the D. A. Tompkins Co., Charlotte, N. C., will erect a plant at Delworth, N. C., for the manufacture of cotton mill machinery and supplies.

The Western Iron & Steel Co., Lakeview, Wash., is building a 30x60 ft. addition to the main building of its rolling mill plant.

The Chandler & Taylor Co., Indianapolis, Ind., has com-

menced the erection of its new shops on ground purchased a few months ago west of the city, consisting of 22 acres. Two buildings, each 275x120 ft., and to be used for foundry and boiler shop, will be built at present.

The Pawtucket Foundry Co.'s new foundry in Pawtucket, R. I., is nearing completion. The two-story board building, 50x60 feet brick, is finished, and the brick work on the molding room, 60x20 feet, is about done. The plant will be under the management of F. A. Thomas.

The Horton Bridge Co. is said to have under consideration the erection of a plant in La Crosse, Wis.

The Pittsburg District:—

The Prime Western Spelter Co., with works located at Gas, Kan., have opened a Pittsburg sales office at 616 Empire Building. L. T. McRae is in charge.

J. D. Lyon & Co., merchant engineers, with offices at 347 Fifth Avenue, have been appointed sole agents for the Pittsburg district of the Abendroth & Root Mfg. Co. of New York, manufacturers of the Root Water Tube Boilers and spiral riveted pipe.

The Carnegie Steel Co. has completed the shipment from its Homestead steel plant a lot of plates for the Mexican Central railway which will be used in the reconstruction of the docks at Galveston, Tex.

The Epping-Carpenter Co. of Pittsburg has been awarded the contract for the construction of a large pumping engine for the Howard Street pumping station by the city of Allegheny. The contract price was $11,108.

It was officially announced last week that an addition, to cost no less than $500,000, would be built to the present plant of the Shiffler Bridge Co., of the American Bridge Co. at West Homestead.

The Paige Woven Wire Fence Co., with plants at Adrian, Mich., and Monessen, Pa., which was placed in the hands of a receiver on August 10, 1900, was reorganized at Chicago last week, the capital stock being increased from $500,000 to $1,000,000. Immediately 50 per cent of the indebtedness of the company, amounting to nearly $640,000 was paid off and this week application was made in the courts for the discharge of the receiver. In the reorganization the stockholders agreed to scale their holdings to pay for the promotion and the subscribers to the new stock were given permission to name five directors, giving them a majority on the board. Charles E. Pain, Austin Clemen, Arthur B. Cody, David N. Hanson and Samuel W. McMunn are the new directors. Until 1899 the company purchased its wire in the open market. At that time it was decided to erect a rod and wire mill and 15 acres were secured on the P. & L. E. road at Monessen, Pa. A plant was erected that cost $600,000 with a capacity daily of 100 tons of wire. Short time paper was given to defray the cost of the new plant and when this fell due last summer and the company was not in a position to meet all claims it was deemed the wisest policy to appeal to the court in order to save the property. The company has been making large profits during the entire period of the receivership.

Arrangements have been made by the St. Clair Steel Co. of Pittsburg, recently organized by the Crucible Steel Co. of America, to erect a large open-hearth steel plant along the Monongahela river to probably consist of 12 50-ton furnaces, together with a blooming and billet mill. The billets thus produced will be used by the Crucible Steel Co. of America. To make these improvements it is intended to issue $2,250,000 of 5 per cent gold bonds. It is provided that in 1904 bonds to the amount of $150,000 shall be redeemed and each year thereafter until the entire issue is recalled. The bonds will be ready for issue by March 1, but it is stated that nearly the entire issue has already been subscribed for. The Garrett-Cromwell Engineering Co. of Cleveland, will design the plant.

Hyde Bros. & Co., Lewis Bldg., Pittsburg, have recently put in a number of their boilers to work on puddling furnaces at the works of the Pittsburg Forge & Iron Co. of Pittsburg and it is stated that they are giving excellent results. They are also putting in a third contract for the American Car & Foundry Co. of Detroit, and have just completed a third contract for Spang, Chalfant & Co. of Pittsburg, and a fourth contract for the Palmer Steel & Iron Co. of Muncie, Ind., now known as the American Rolling Mill Co. They are putting in two boilers for the Ohio Falls Iron Co. of New Albany, Ind., and 750-h. p. of boilers for Messrs. Timmes & Hecht, who are building a plant at Scranton, Pa.

Chicago District and Northwest:—

The Firth-Sterling Steel Co. has leased the building at 53-55 North Desplaines St., Chicago, for warehouse purposes. It has been the practice of this concern heretofore to supply the Western trade from Pittsburg, and the frequent delays induced the opening of this warehouse in Chicago.

The Morava Construction Co. has been incorporated at Chicago, with a capital stock of $50,000, to manufacture structural iron and do a construction business. The incorporators are Wensel Morava, Winslow H. Foster and Burton L. Morse. The company will erect a bridge shop at Eighty-fifth St. and Stewart Ave., Chicago. The building will be 100 by 200 feet in size, of steel frame and glass and corrugated iron sides and roof.

Samuel Green & Sons, Des Moines, Ia., will make considerable additions to their foundry and furnace manufacturing plant. The improvement will cost about $50,000. It will include the erection of new buildings, doubling the capacity of the furnace department, the addition of a stove manufacturing and casting department, and the addition of a new and fully equipped machine shop. A new foundry will be built and a new lighting system and power plant added.

The Hutchinson Lock Mfg. Co. has been incorporated at Bourbon, Ind., with a capital stock of $10,000, by Robert W. Hutchinson, Edgar Hayslett and Arthur C. Proberts.

The Garden City Sand Co. has received an order for 40,000 barrels of Portland cement to be delivered in Chicago, and an order for 10,000 barrels of A A Portland cement to be delivered to a large manufacturer of sidewalk tiles at Minneapolis, Minn.

The plant of the Flour City Ornamental Iron Works, Minneapolis, Minn., is being enlarged considerably to meet the growing requirements of the company's business.

The T. L Knudston Machinery Mfg. Co. has been incorporated at Chicago, to do a general manufacturing business. The incorporators are Thurston L. Knudston, Milton Dailey and John C. Edwards.

General Industrial Notes:—

The November (1900) statement of the net earnings of the Colorado Fuel & Iron Co., as compared with the same period of 1899, is as follows: Nov., 1900, $225,467.05, and Nov., 1899, $219,251.38, an increase of $6,215.67; for the five months ending Nov. 30, 1900, $1,145,486.94, and for the same period in 1899, $753,373.64, an increase of $392,113.31. The amount paid in bond interest, taxes and preferred stock dividend for the entire year to June 30, 1901, was $601,790, which deducted from the net earnings for the five months ending Nov. 30, 1900, leaves a surplus of $543,696.94 over all charges for the entire year.

The Beck & Corbitt Iron Co., St. Louis, Mo., has purchased the entire stock of the Globe File & Iron Co., St. Louis. The officers of the latter company will be added to the official board of the former company.

The Richmond Locomotive Works, Richmond, Va., has received an order for 50 locomotives for the Wabash railroad. The contract price is about $650,000.

The Claire Furnace Co., Sharpsville, Pa., will make application for a charter on Jan. 25. The incorporators are A. M. Robbins, of Cleveland, A. W. Thompson, Louis T. Kurtz, William S. Foltz of New Castle, Pa., L. J. Robbins of Sharon Pa. The concern will operate Claire Furnace at Sharpsville.

New locomotive and car orders are noted in the *Railway Gazette* of Jan. 10, as follows: The Baldwin Locomotive Works, 20 locomotives for the Choctaw, Oklahoma & Gulf; 5 for the Wheeling & Lake Erie, and one for the Lexington & Eastern; The Pittsburg Locomotive & Car Works, one locomotive for the Midvale Steel Co. The Michigan Central and the Colorado Southern are each reported in the market for 10, and the Kansas City Belt for 2 locomotives. The Great Northern is preparing specifications for a number of locomotives. The American Car & Foundry Co. has orders for 1,100 coal cars for the Toledo & Ohio Central; 250, it is said, for the Wheeling & Lake Erie, and 600 for export; the Illinois Car & Equipment Co., 500 box cars for the Atchinson, Topeka & Santa Fe, and 100 furniture cars for the Chicago, Rock Is-

COCHRANE STEAM SEPARATORS

Cross Section.

When you come to the problem of "What make of Steam Separator shall I use?" just bear this in mind: Calorimeter tests to ascertain the quality of or amount of water contained in steam give truer readings when the calorimeter is placed in a vertical than when it is used in a horizontal pipe. Why?

Simply because when the steam turns up into a vertical pipe the water traveling with it is thoroughly broken up and mixed with the current of steam, and all the water is taken up with the steam. FOR EXAMPLE: Did you ever try to pour a pitcher of water down an open exhaust stack when the engine was running? You simply cannot get the water to run down—the steam blows it out.

Now many of the Separators on the market today are so badly designed that the opportunity is given for the steam to pick up and carry through the water taken out. Not so with the "Cochranes"; the steam is free to pass through the Separator, the water is allowed to fall out of the course of the current of steam by gravity, and so carried within the Separator that the current cannot interfere with it or pick it out.

So much for the design. As for the construction our experience covers the manufacture of all sizes, kinds and shapes, from the little fellow ¼-in. in diameter up to those for 48-in. pipe.

These "COCHRANES" are what you would call well made. Everything about them—materials, fittings, valves, gaskets, bolts, etc.,—are FIRST CLASS.

Our catalogue for the asking.

Harrison Safety Boiler Works, Clearfield & 17th Streets, PHILADELPHIA, PA.

land & Pacific, which road is also in the market for 500 box cars; the Erie Car Works, 100 refrigerator cars for the Erie; the Rodger Ballast Car Co., 63 standard ballast cars for the Durr Construction Co., Bethlehem, Pa., and 40 for the Gulf & Ship Island. The Choctaw, Oklahoma & Gulf has ordered 350 freight cars from the Southern Car & Foundry Co., 400 from the Mt. Vernon Car Mfg. Co., and 100 from the Georgia Car & Mfg. Co.

The stockholders of the Marting Iron & Steel Co., Ironton, O., held their annual meeting on Jan. 7, and re-elected as directors G. J. Gilbert, J. H. King, Col. H. A. Marting, W. A. Murdock, Col. E. J. Bird, Jr., and A. H. Mittendorf.

The German National bank, Allegheny, Pa., has been enjoined until April 1, from foreclosing its mortgage of $25,000 held against the Wheatland, Pa., mill of the insolvent Continental Iron Co. If the trustees can show that the mill can be operated at a profit and the debt paid in a reasonable time, the injunction will be made permanent. The mill will resume on skelp in about two weeks.

The Cleveland Punch & Shear Works Co. of Cleveland is receiving many inquiries for its machines, and some of them have developed into orders within the past few days. One order is for one of the company's 50-inch rotary planers from the Carnegie Steel Co. There have been shipped in the past few days the following tools: One special "I" beam punch, one 16-ft. radial drill, and one bending and straightening machine to McMath & Colburn, Walkerville, Ont.; one double 48-inch throat punch to the Eastern Ship Building Co., New London, Conn.; one 50-inch rotary planer to the Rochester Bridge & Iron Works, Rochester, N. Y.; one 12-ft. arm radial drill to the Buffalo Dry Dock Co., Buffalo, N. Y.; one double 30-inch throat punch to the Anaconda Copper Mining Co., Anaconda, Mont.; one 36-inch throat punch to the Craig Ship Building Co., Toledo, O., and several other punches and shears to various firms.

The Weimer Machine Works Co., of Lebanon, Pa., has just completed the installation of the Uehling pig iron casting machine and started the machine at the furnace plant of Richard Heckscher & Sons Co., Swedeland, Pa. The company is now at work erecting the same kind of machines at the furnace plants of the Warwick Iron & Steel Co., Pottstown, Pa., and of Joseph Wharton, Port Oram, N. J.

The "Quick-as-Wink" hose coupling has been found to be a time saver in shops where compressed air is used, and is now coming into general use on hose for pneumatic tools and machines. Frick & Lindsay of Pittsburg, who deal largely in pneumatic hose, have contracted with the W. J. Clark Co. of Salem, O., the manufacturers, for a continued supply of these couplings for such purpose.

The recently organized Oneida Steel Pulley Co. of Oneida, N. Y., made its first shipment of pulleys last week.

The Sharon Boiler Co. of Sharon, Pa., has received contracts for four boilers for the Sharon tin plate plant and one each for the Dunbar furnace, Dunbar, Pa., and the Paxton furnace, Huntingdon, Pa.

The Illinois Central Railroad Co. has ordered 40 locomotives from the Pittsburg Locomotive Works.

The Niles, O., furnace of the National Steel Co. resumed operations this week.

Many rumors have been circulated during the past week anent the erection of additional bar mills by the American Steel Hoop Co. at Youngstown, O. We have been officially advised that nothing has yet been definitely decided upon, although the matter is under consideration. The Republic Iron & Steel Co., it is understood, is to manufacture hoops and bands at its Brown-Bonnell plant.

It is reported from Sharon, Pa., that a stock company is being organized to convert the Kimberly mill, dismantled by the American Steel Hoop Co. into a foundry and machine shop.

At the annual meeting of the stockholders of the Lebanon Foundry Co. of Lebanon, Pa., held last week, directors were elected as follows: Dr. J. H. Mease, G. B. Woomer, Frank Bowers, J. Davis and C. Dunn. Dr. J. H. Mease was then elected president and Frank Bowers, general manager. It was decided to enlarge the plant to double its present capacity and an addition 60 feet square will be built.

The Hall blast furnace of the Republic Iron & Steel Co. at

Pig Iron

Made in Alabama by the SLOSS-SHEFFIELD STEEL & IRON COMPANY. . . .

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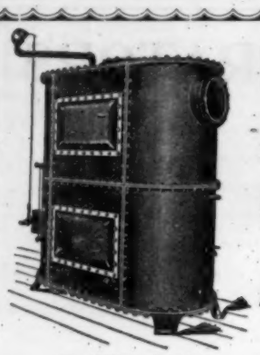

Feed-Water Heater.

FEED WATER HEATERS

Cut herewith illustrates Stillwell's latest design. **Made entirely of cast Iron.** Saves fuel and filters the feed water for steam boilers. Use only exhaust steam.

BOILER FEED PUMPS

SINGLE, DUPLEX AND TRIPLEX.

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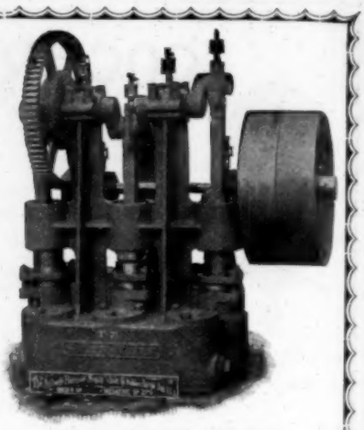

Triplex Boiler Feed Pump.

Sharon, Pa., which went out of blast several months ago, resumed operations this week.

The furnace of the Empire Steel & Iron Co. at Shenandoah, Va., has again been shut down. The plant was improved one year ago at an expense of $82,000 after an idleness of eight years.

The steel plant of the Republic Iron & Steel Co. at Youngstown, O., which has been shut down for about ten days, resumed this week. Extensive repairs were made during this period.

The Interstate Foundry Co. of Cleveland, O., has opened a branch foundry at Ashtabula, O., which employs about 40 men.

The bar and puddling mills of the Ohio Falls Iron Works at New Albany, Ind., resumed operations last week and the eight and ten inch mills resumed this week. While the plant was shut down repairs costing about $25,000 were made.

The wage contention which has been going on at the La-Belle Steel Co. plant at Wheeling, W. Va., since the settlement of the puddling scale between the management and its employes, members of the Amalgamated Association, is to be arbitrated. The owners of the plant contend that concessions should be made owing to improvements made in the furnaces, while the puddlers insist that the regular scale be paid.

The Elliott-Blaire Cold Rolled Steel Co. of New Castle, Pa., is looking for a new location. It is the intention to add a hot rolling department to the plant upon the new site.

The Ames Iron Works Co., Oswego, N. Y., has been incorporated with $100,000 capital, to succeed the partnership which has carried on boiler manufacture.

The annual meeting of the directors of the Cambria Steel Co. was held at Philadelphia, Pa., last week. The usual quarterly dividend of 50 cents per share was declared. The annual report shows that the total income from operation for the year ending Oct. 31, 1900, was $3,043,258, being an increase of $1,457,201. Out of this the rental of $338,720 to the Cambria Iron Co. is paid, and also $481,151 for depreciation in stock of raw material on hand. There remains $3,092,387 net earnings, an increase of $1,065,050, and of this dividends take $2,560,000, an increase of $1,440,000 over the previous year. There is left $532,387 surplus, and the whole surplus to credit of profit and loss is $1,735,517. During the year the expenses for new property and plant were $2,441,417.

It is altogether probable that the Structural Iron & Steel Co. of Baltimore, Md., will shortly increase its annual output from 12,000 tons to 24,000 tons by the erection of large additions to its present plant. Since the organization of the company last June it has had more orders on its books than could be filled and there is little doubt but that large improvements will be authorized at a directors' meeting to be held soon.

C. M. Ryder, of Chester, Pa., has about completed the erection of the open-hearth furnaces for the Seaboard Steel Casting Co. and will soon leave for North Carolina, where he has secured a contract for the erection of a number of open-hearth furnaces for a steel casting plant.

The report of the receiver of the Stevenson-Field Co. of Columbus, O., filed with the court last week, shows that the assets amount to $106,465.39 and the liabilities to $92,694.40.

The stockholders of the Geneva Metal Wheel Co. last week elected directors as follows: D. J. C. Arnold, C. E. Barnum, A. G. Kinyon, F. S. Turner, A. W. Chamberlain, R. S. Giles, A. J. Ford, P. W. Tuttle and A. S. Hickok. The directors then elected C. E. Barnum, president; D. J. C. Arnold, vice president; F. S. Turner, treasurer; A. W. Chamberlain, secretary.

The Berlin Construction Co. of New York, recently granted a New Jersey charter with a capital of $100,000, have opened offices at 220 Broadway, N. Y., and at Berlin, Ct. Officers are

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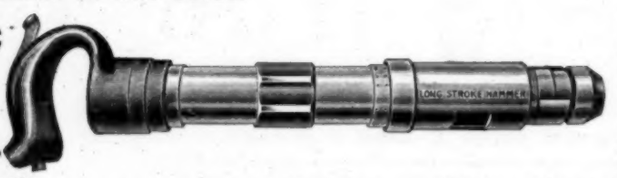

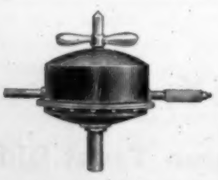

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as follows: D. E. Bradley, president; George H. Sage, vice president, and S. N. Robinson, treasurer.

The furnace of the LaFollette Coal and Iron Co. at LaFollette, Tenn., which is being remodeled and enlarged, will resume operations about April 1.

The Colorado Fuel & Iron Co. has broken ground at Pueblo, Col., for a second large new furnace.

The Sharon Boiler Works of Sharon, Pa., has been awarded a contract for the erection of a large stand pipe at Buenos Ayres.

Citizens of Brazil, Ind., recently held a public meeting to raise funds for the purpose of building a rolling mill to supplant the mill absorbed by one of the consolidations.

The Meehan Boiler & Construction Co. of Lowellville, O., has placed a contract with the Cleveland Punch & Shear Co. of Cleveland, O., for the erection of a bending and straightening machine.

The plant of the Alabama Metal Roofing Co. at Birmingham, Ala., will commence operations in about two weeks. In addition to manufacturing corrugated roofing, siding and ceiling machinery will soon be added to manufacture steel wheelbarrows, coal scuttles, shovels and similar articles.

The Elk Valley Coal & Iron Co. of Tennessee announces that it will open its coal and iron ore mines about Feb. 1.

Work on the new plant of the Cramp Ontario Steel Co., at Collingwood, Ont., will be begun shortly. The site given as a bonus comprises 50 acres with some water lots giving a water frontage of 1,200 feet. This, with the Grand Trunk Railway, affords abundant shipping facilities. The dock will have a depth of 18 feet, and will admit the unloading of two vessels at once. Ore from the Helen mine, at Michipicoten, will be mainly used. Connellsville coke, which can be carried to the furnaces for less than the freight on the ore from Lake Superior to Pittsburg, will be used as fuel. Chas. D. Cramp is president, and capital from several cities of the United States is interested. Among Canadian representatives of the company are: F. H. Clergue, Sault Ste. Marie; John J. Long, Collingwood; Senator Gowan, Barrie; Sir Charles Hibbert Tupper, and W. C. Matthews, Toronto.

Wages for turn work at Valley blast furnaces, since Feb. 1,

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1899, before the boom, have fluctuated as follows: Feb. 1, 1899, $1.50; March 1, 1899, $1.65; Sept. 1, 1899, $1.90; Jan. 1, 1901, $1.65.

The Mary furnace of the Ohio Iron & Steel Co., at Lowellville, O., resumed on Jan. 3, after having been banked for two months.

At a meeting of the stockholders of the Niles Iron & Sheet Co., Niles, O., held Jan. 3, it was decided to increase the capital stock to $200,000.

Wages were reduced 10 per cent on Jan. 1, in all departments of the Pennsylvania Steel Co., Steelton, Pa. The reason assigned by the company is the low prices obtained for its products. The cut affects over 6,000 men, and reduces the annual wages by over $200,000.

Trustee J. A. Campbell of the Continental Iron Co., has received a formal order from the U. S. Circuit Court to start the Wheatland, Pa., mill. The order authorizes also the removal of the stock and supplies from the Sharon, Pa., mill.

At the meeting of the stockholders of the National Roofing & Corrugating Co., held at Wheeling, W. Va., Jan. 4, the following directors were elected: G. E. Needham, Cleveland; R. T. Scott, Cambridge, O.; F. J. Hyndman, Cincinnati; F. C. Robbins, Niles, O.; C. F. Clark, Canton, O.; F. C. Caldwell, Wheeling, W. Va.

Scott Braddock and A. T. Hall, Logan, O., have purchased the Logan Foundry & Machine Co. from Pierce McKay. The name of the plant will remain unchanged.

The Sharon Boiler Co., Sharon, Pa., has taken the contract to erect a large stand pipe and several tanks, near Buenos Ayres, Argentine Republic.

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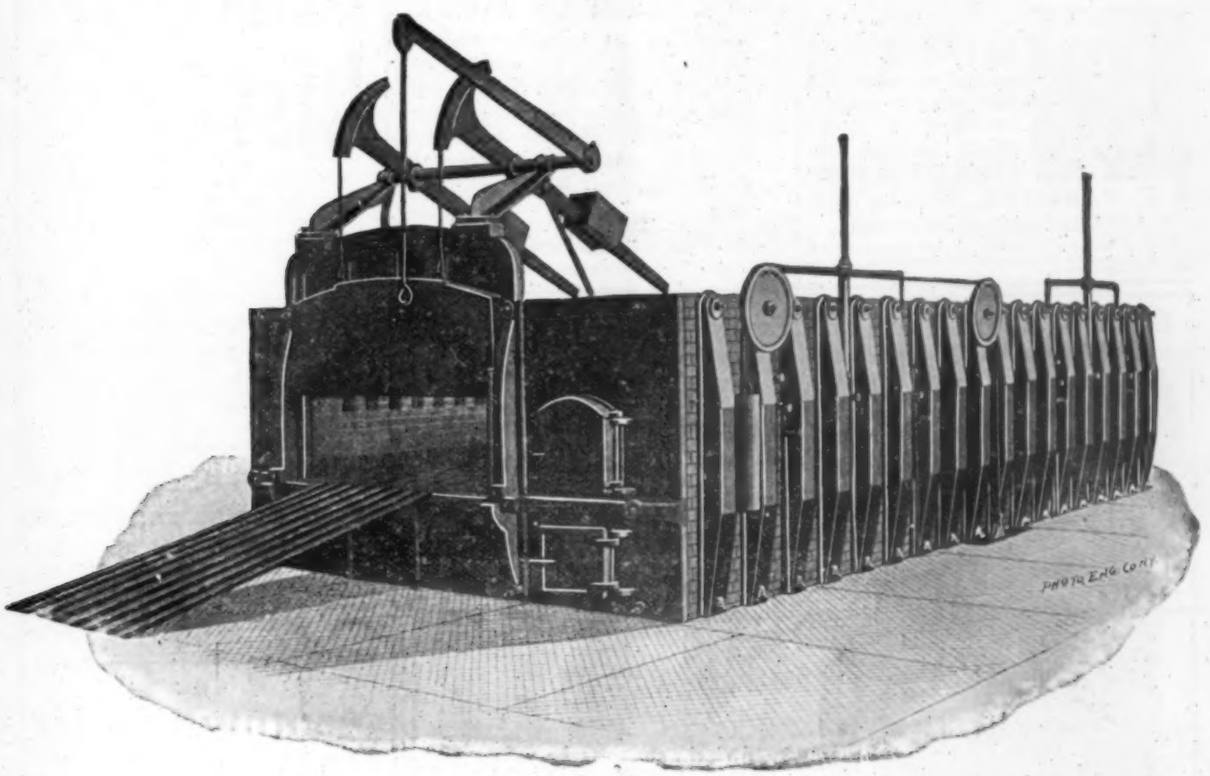

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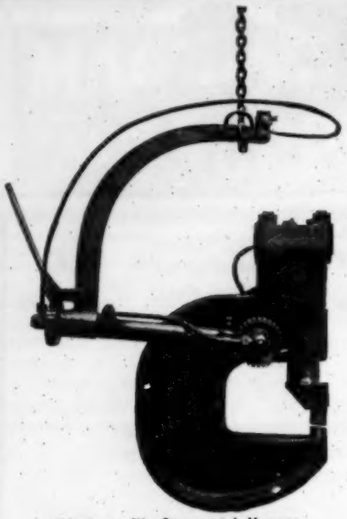

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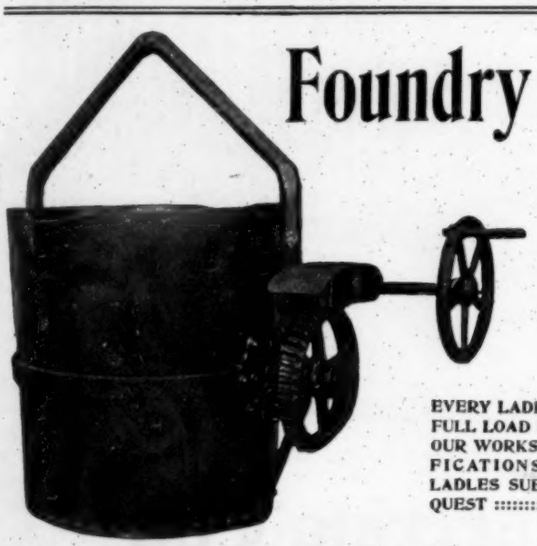

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4:25	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6:05
5:15	1:57	8:00	Lester	8:15	10:41	5:47
3	3	1	Main Line	2	4	6
4:40	1:00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester	8:10	10:40	5:40
5:56	2:11	8:23	Medina	7:55	10:30	5:26
6:19	2:30	8:43	Seville	7:33	10:10	5:05
6:26	2:36	8:49	Sterling	7:27	10:04	4:59
6:48	2:58	9:11	Warwick	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover	5:55	8:34	3:26
8:08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.	.....	8:10	3:00
	6:50	1:15	Bridgeport	.....	6:10	1:00
	7:05	.....	Bellaire	.....	5:55	.....
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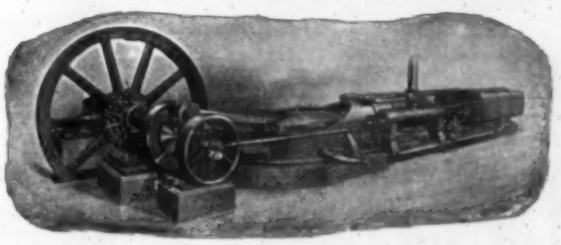

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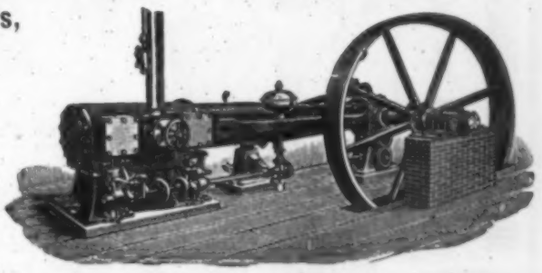

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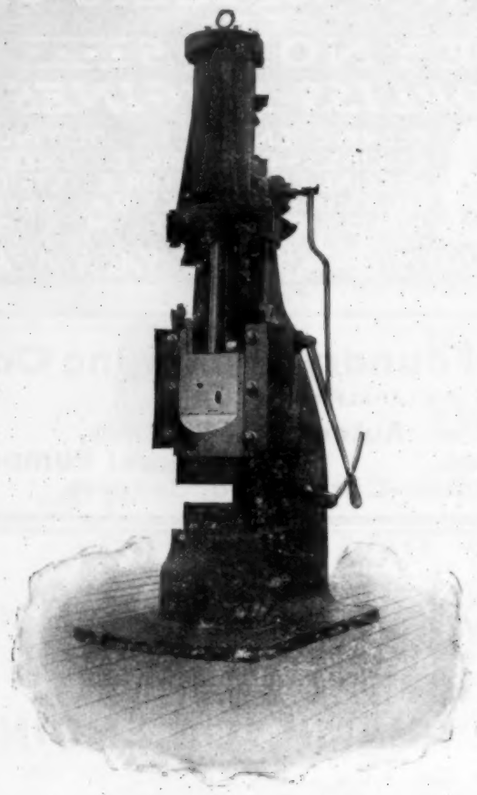

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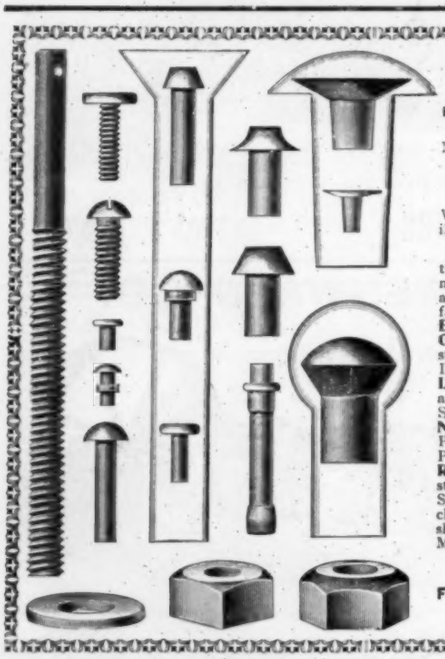

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

Numerous miscellaneous tables have been added, which, it is hoped, will be found of value

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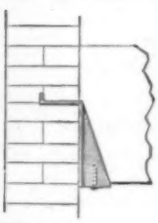
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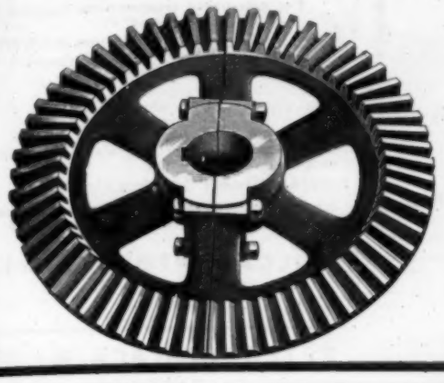

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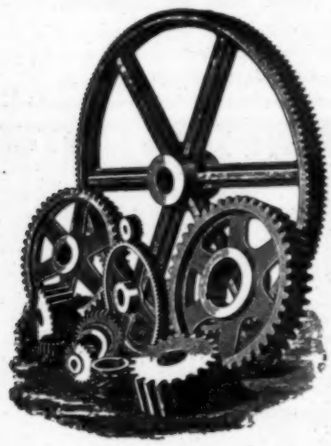

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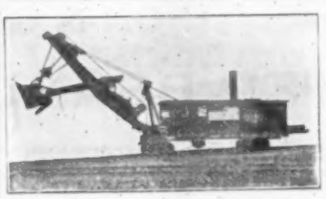

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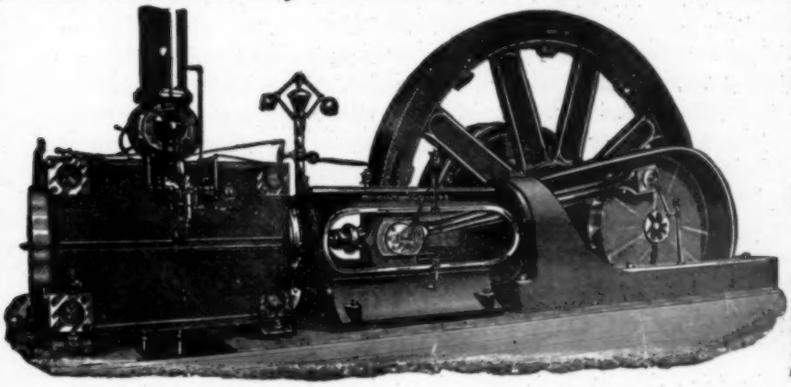

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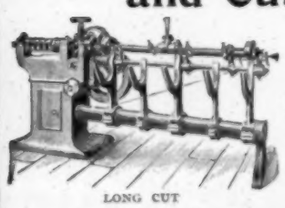
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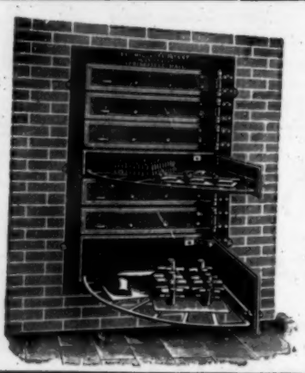

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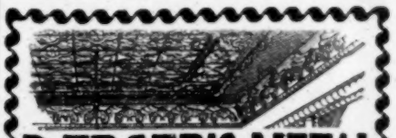

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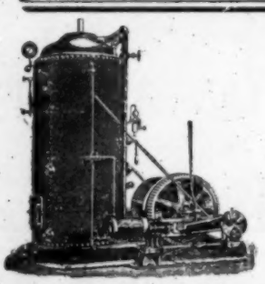

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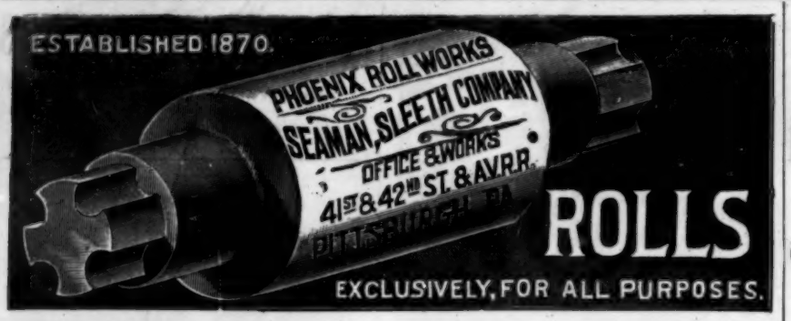

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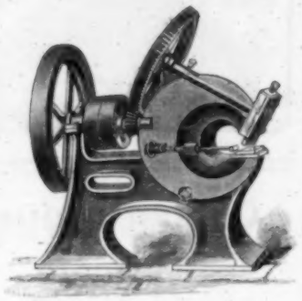

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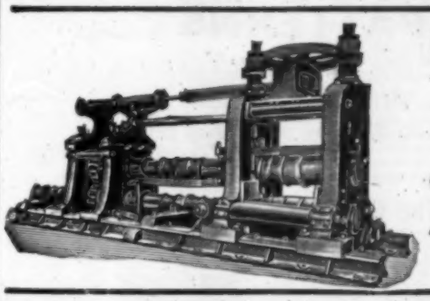

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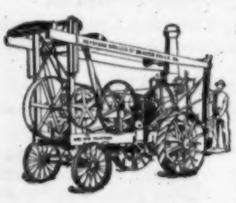

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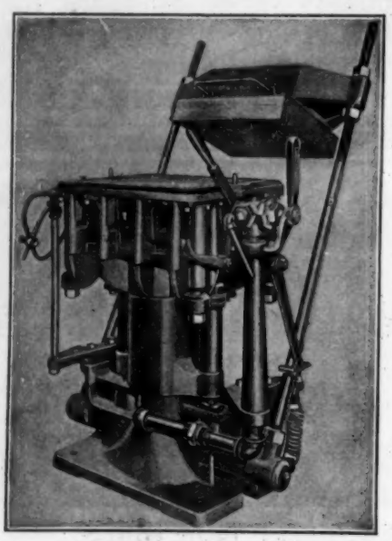

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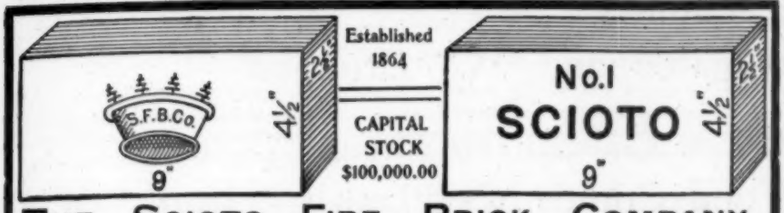

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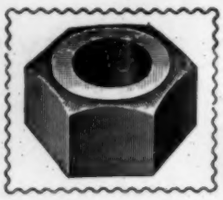

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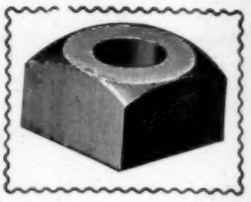

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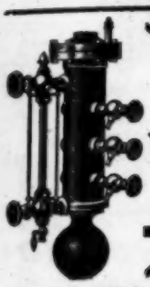

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The Lunkenheimer Co., Cincinnati, O.

CASTINGS (MALLEABLE)—
Acme Steel & Malleable Iron Works, Buffalo.
Meadville Malleable Iron Co., Meadville, Pa.

CASTINGS (STEEL)—
Acme Steel & Malleable Iron Works, Buffalo.
Bethlehem Steel Co., South Bethlehem, Pa.
Otis Steel Co., Cleveland, O.
The Sargent Co., Chicago, Ill.

CAULKING HAMMERS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

CEMENT—
Reed F. Blair & Co., Pittsburg, Pa.
Garden City Sand Co., Chicago, Ill.

CHAIN—
Standard Chain Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

CHAIN BELTING—
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHANNELS—
American Steel Hoop Co., New York City.

CHEMISTS—
Geo. C. Davis, Philadelphia, Pa.
F. A. Emmerton, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
O. Texter, Cleveland, O.

CHILLED AND SAND ROLLS—
Canton Roll & Machine Co., Canton, O.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

CHIPPING HAMMERS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

CHUCKS—
Pratt Chuck Co., Frankfort, N. Y.
Somers, Fitler & Clarke, Pittsburg, Pa.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.

COAL SCREENS—
Rob't Aitchinson Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
Western Machinery & Supply Co., Chicago, Ill.

COAL AND COKE—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
Bessemer Coke Co., Pittsburg, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
A. M. Crane & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
The Rob't Field Co., Columbus, O.
O'Gara, King & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pilling & Crane, Philadelphia, Pa.
Pickand, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

COAL HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Link Belt Machinery Co., Chicago, Ill.
Webster, Camp & Lane Machine Co., Akron, O.

COLD SAWS—
J. R. Vandyck, New York City, N. Y.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, O.

CONDENSERS—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

CONTRACTORS' SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYING MACHINERY—
American Engineering Works, Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYORS—
Exeter Machine Works, Pittston, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland.
Webster Camp & Lane Machine Co., Akron, O.

COPPER GASKETS—
Drake Acetylene Apparatus Co., Cleveland, O.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRESPONDENCE SCHOOLS—
International Correspondence Schools, Scranton, Pa.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Sheet Steel Co., New York City.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

CRANES—
Atlas Machine Co., Pittsburg, Pa.
The Brown Hoisting Machinery Co., Cleveland.
The Bucyrus Co., South Milwaukee, Wis.
Cleveland Crane & Car Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Marion Steam Shovel Co., Marion, O.
Torbert & Peckham, Chicago, Ill.
R. D. Wood & Co., Philadelphia, Pa.
Wm. Tod & Co., Youngstown, O.

CRANES AND DERRICKS—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CRUSHING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Wm. B. Pollock Co., Youngstown, O.
S. Obermayer Co., Cincinnati, O., and Chicago, Ill.
The United Boiler Co., Girard, O.

DECALCOMANIAS—
Scientific Manufacturing Co., Chicago, Ill.

DIES—
American Steel & Wire Co., Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.
Thew Automatic Shovel Co., Lorain, O.

DRILL GRINDERS—
J. Wendell Cole, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
C. H. Besly & Co., Chicago, Ill.
Jos. E. Bissell, Agt. Prentiss Tool & Supply
U. Baird Machinery Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

DROP FORGINGS—
E. D. Clapp Mfg. Co., Auburn, N. Y.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia.
Wyman & Gordon, Worcester, Mass.

DROP HAMMERS—
Cleveland Punch & Shear Wks. Co., Cleveland.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., Bethlehem, Pa.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELECTRICAL MACHINERY SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.
Pelton Engineering Co., Cleveland, O.

ELECTRICAL WIRES AND CABLES—
American Steel & Wire Co., Chicago, Ill.

ELEVATING AND CONVEYING MACHINERY—
The Aultman Co., Canton, O.
American Engineering Works, Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland, O.
Exeter Machine Works, Pittston, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Webster Camp & Lane Machine Co., Akron, O.

EMERY AND CORUNDUM WHEELS—
C. H. Besly & Co., Chicago, Ill.
The Carborundum Co., Niagara Falls, N. Y.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

EMERY WHEEL MACHINERY—
C. H. Besly & Co., Chicago, Ill.
J. Wendell Cole, M. E., Columbus, O., or Chicago.
Northampton Emery Wheel Co., Chicago, Ill.

ENGINEERS AND CONTRACTORS—
American Engineering Works, Chicago, Ill.
Alex. Laughlin & Co., Pittsburg, Pa.
The Best Manufacturing Co., Pittsburg, Pa.
E. E. Erickson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Julian Kennedy, Pittsburg, Pa.
David Lamond, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wellman-Seaver Engineering Co., Cleveland, O
Walter Kennedy, Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.

ENGINE PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Il.
Jenkins Bros., New York City.
The Lunkenheimer Co., Cincinnati, O.
The Crane Co., Chicago, Ill.
Drake Acetylene Apparatus Co., Cleveland, O.
Wright Mfg. Co., Cleveland, O.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

ENGINES (Oil) —
The Aultman Co., Canton, O.

ENGINES (Steam)—
The Aultman Co., Canton, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Wickes Bros., Pittsburg, Pa.

ENGRAVERS AND ELECTROTYPERS—
Rosenow & Co., Chicago, Ill.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTER PRESSES—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FILTERS—
Pittsburg Filter Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
Chicago Fire Brick Co., Chicago, Ill.
Clearfield Fire Brick Co., Clearfield, Pa.
Crown Fire Clay Co., Akron, O.
Dover Fire Brick Co., Cleveland, O.
John H. Ehlen, Newport, Ky.
Garden City Sand Co., Chicago, Ill.
A. J. Hawes & Son, Johnstown, Pa.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Fire Brick Works, Portsmouth, O.
Keystone Fire Clay Co., Lisbon, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
S. Obermayer Co., Cincinnati, O., and Chicago.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
J. V. Rose & Son, Sharon, Pa.
F. B. Stevens, Detroit, Mich.
Scioto Star Fire Brick Works, Portsmouth, O.
A. F. Smith & Co., New Brighton, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Union Mining Co., Mt. Savage, Md.
Webster Fire Brick Co., South Webster, O.

FIRE PROOF COVERING—
C. H. Besley & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Bethlehem Steel Co., South Bethlehem, Pa.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
E. D. Clapp Mfg. Co., Auburn, N. Y.
Cleveland City Forge & Iron Co., Cleveland, O
Frankford Steel & Forging Co., Philadelphia.
Wyman & Gordon, Worcester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Pilling & Crane, Philadelphia, Pa.
Vulcanus Forging Co., Cleveland, O.

FOUNDRIES—
E. R. Allen, Corning, N. Y.
The Aultman Co., Canton, O.
Best Mfg. Co., Pittsburg, Pa.
Brass Founders' Supply Co., Newark, N. J.
Hooven, Owens & Rentschler Co., Hamilton, O.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry Co., Chicago.
Link Belt Machinery Co., Chicago, Ill.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.
Seaman, Sleeth Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Wheeling Mold and Foundry Co., Wheeling, W. Va.

FOUNDRY EQUIPMENT—
Jos. E. Bissell, Agt. Prentiss Tool & Supply
The W. J. Clark Co., Salem, O.
Brass Founders' Supply Co., Newark, N. J.
Cleveland Crane & Car Co., Cleveland, O.
Co., Pittsburg, Pa.
Chicago Pneumatic Tool Co., Chicago, Ill.
Macleod & Clark, Cincinnati, O.
Millett Core Oven Co., Brightwood, Mass.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Tabor Mfg. Co., Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.
S. Obermayer Co., Cincinnati, O., and Chicago.

FOUNDRY SUPPLIES—
Brass Founders' Supply Co., Newark, N. J.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
John H. Ehlen, Newport, Ky.
Cleveland Facing Mill Co., Cleveland, O.
Chicago Fire Brick Co., Chicago, Ill.
Crown Fire Clay Co., Akron, O.
Dover Fire-Brick Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
A. J. Haws & Son, Johnstown, Pa.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Fire Brick Works, Portsmouth, O.
Keystone Fire Clay Co., Lisbon, O.
Millett Core Oven Co., Brightwood, Mass.
Newport Sand Bank Co., Newport, Ky.
Northern Engineering Works, Detroit, Mich.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
S. Obermayer Co., Cincinnati, O., and Chicago.
The Ohio Sand Co., Conneaut, O.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
J. V. Rose & Son, Sharon, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
A. F. Smith & Co., New Brighton, Pa.
F. B. Stevens, Detroit, Mich.
Scioto Star Fire Brick Works, Portsmouth, O.
Tabor Mfg. Co., Philadelphia, Pa.
Union Mining Co., Mt. Savage, Md.
Vulcan Mfg. Co., Pittsburg, Pa.
Webster Fire Brick Co., South Webster, O.
Webster Foundry Sand Co., Philadelphia, Pa.

FRICTION METAL—
C. H. Besly & Co., Chicago, Ill.
Theo. Hierta & Son, St. Louis, Mo.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GAGE COCKS—
The Lunkenheimer Co., Cincinnati, O.

GALVANIZED IRON—
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.

GALVANIZERS—
American Sheet Steel Co., New York City.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Atlas Machine Co., Pittsburg, Pa.
Columbus Machine Co., Columbus, O.
Northern Engineering Works, Detroit, Mich.
Somers, Fitler & Clarke, Pittsburg, Pa.

GAS PRODUCERS—
R. D. Wood & Co., Philadelphia, Pa.

GAUGES (Rolling Mill)—
Haines Gauge Co., Philadelphia, Pa.

GEARING—
James Bonar & Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
The Van Dorn & Dutton Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.
The R. D. Nuttall Co., Allegheny, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
F. H. Bultman & Co., Cleveland, O.
The Van Dorn & Dutton Co., Cleveland, O.
The R. D. Nuttall Co., Allegheny, Pa.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.

HACK SAWS—
Cleveland Punch & Shear Wks. Co., Cleveland.

HANGERS—
The Aultman Co., Canton, O.
E. A. Delano, Chicago, Ill.
I. & E. Greenwald Co., Cincinnati, O.
Dodge Mfg. Co., Mishawaka, Ind.
Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Aultman Co., Canton, O.
The Edward P. Allis Co., Milwaukee, Wis.
Exeter Machine Works, Pittston, Pa.
Lidgerwood Mfg. Co., New York City.
Somers, Fitler & Clarke, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Webster, Camp & Lane Machine Co., Akron, O.

HOISTING MACHINERY—
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleve-
A. Leschen & Sons Rope Co., St. Louis, Mo.
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
land, O.
Webster, Camp & Lane Machine Co., Akron, O.

HOISTING ROPE (Wire)—
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES—
American Steel & Wire Co., Chicago, Ill.
Phoenix Horse Shoe Co., Joliet, Ill.

HYDRAULIC TOOLS—
R. D. Wood & Co., Philadelphia, Pa.

INDUSTRIAL CARS—
The Atlas Car & Mfg. Co., Cleveland, O.
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
American Bridge Co., New York City.
Illinois Steel Co., Chicago, Ill.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
McCullough Iron Co., Wilmington, Del.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Drake, Bartow & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Jerome Keeley & Co., Philadelphia, Pa.
Lake Superior Consolidated Iron Mines, New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Tod, Stambaugh & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.

IRON WORKING MACHINERY—
Atlas Machine Co., Pittsburg, Pa.

IRON WORKING TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Avery Stamping Co., Cleveland, O.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
Jos. K. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Thos. P. Conard, Philadelphia, Pa.
Pratt Chuck Co., Frankfort, N. Y.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
C. C. Wormer Machinery Co., Detroit, Mich.

LADLES—
The W. J. Clark Co., Salem, O.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

LAG SCREWS—
Vulcanus Forging Co., Cleveland, O.

LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

LATHE TOOLS—
Armstrong Bros Tool Co., Chicago, Ill.

LINK BELTING—
The Aultman Co., Canton, O.
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

LUBRICATING DEVICES—
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINE TOOLS—
American Engineering Works, Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Atlas Machine Co., Pittsburg, Pa.
U. Baird Machinery Co., Pittsburg, Pa.
C. H. Besly & Co., Chicago, Ill.
Bertsch & Co., Cambridge City, Ind.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
H. Bickford, Lakeport, N. H.
Bickford Drill & Tool Co., Cincinnati, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
Pelton Engineering Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
C. C. Wormer Machinery Co., Detroit, Mich.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINERY AND TOOL STEEL—
American Steel & Wire Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.
Byron H. White, Chicago, Ill.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.

MALLEABLE CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
Link Belt Machinery Co., Chicago, Ill.
Meadville Malleable Iron Co., Meadville, Pa.

MANILLA ROPE—
A. Leschen & Sons Rope Co., St. Louis, Mo.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Grasselli Chemical Co., Cleveland, O.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL SAWS—
J. R. Vandyck, New York City, N. Y.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
A. Garrison Foundry Co., Pittsburg, Pa.
Schuylkill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MILLING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

MINING MACHINERY—
The Edward P. Allis Co., Milwaukee, Wis.
American Engineering Works, Chicago, Ill.
The Atlas Car & Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
The Bucyrus Co., South Milwaukee, Wis.
Wm. Cramp & Sons, Philadelphia, Pa.
Exeter Machine Works, Pittston, Pa.
Fraser & Chalmers, Chicago, Ill.
Jeffrey Mfg. Co. Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Lidgerwood Mfg. Co., New York City.
Link Belt Machinery Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Wm. B. Pollock Co., Youngstown, O.
Raymond Bros. Impact Pulverizer Co., Chicago.
Thew Automatic Shovel Co., Lorain, O.
Torbert & Peckham, Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Webster, Camp & Lane Machine Co., Akron, O.

MINE LOCOMOTIVES—
Jeffrey Manufacturing Co., Columbus, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.

MOLDING MACHINES—
S. Obermayer Co., Cincinnati, O., and Chicago.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SAND—
John H. Ehlen, Newport, Ky.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
S. Obermayer Co., Cincinnati, O., and Chicago.
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Webster Foundry Sand Co., Philadelphia, Pa.

MULTIPLE DRILLS—
Bickford Drill & Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (SELF LOCKING)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
National Elastic Nut Co., Milwaukee, Wis.
Milton Manufacturing Co., Milton, Pa.
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE BARROWS—
The Atlas Car & Mfg. Co., Cleveland, O.

ORE CARS—
The Atlas Car & Mfg. Co., Cleveland, O.
The Pressed Steel Car Co., Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.

ORE HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
Jeffrey Manufacturing Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.

PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.
Iron Clad Paint Co., Cleveland, O.
The Ironsides Co., Columbus, O.

PAINT MACHINES—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PATTERN WORKS—
Balkwill Pattern Works, Cleveland, O.
C. Birnbaum, Cleveland, Ohio.
Forsythe Pattern Works, Youngstown, O.
Gobeille Pattern Co., Cleveland, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
A. M. Crane & Co., Chicago, Ill.
The Rob't Field Co., Columbus, O.
M. A. Hanna & Co., Cleveland, O.
Hickman, Williams & Co., Chicago, Ill.
J. H. Hillman & Son, Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Pilling & Crane, Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Sloss Sheffield Steel & Iron Co., Birmingham, Ala.
Spearman Iron Co., Sharpsville, Pa.
F. B. Stevens, Detroit, Mich.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

PIPE (CAST IRON)—
A. M. Crane & Co., Chicago, Ill.
Massillon Iron & Steel Co., Chicago, Ill.

PIPE (RIVETED STEEL)—
A. M. Crane & Co., Chicago, Ill.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE FITTERS—
The Best Manufacturing Co., Pittsburg, Pa.
Pittsburg Valve, Fdy. & Construc. Co., Pittsburg, Pa.

PISTON AIR DRILLS—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PISTON RODS—
Bethlehem Steel Co., South Bethlehem, Pa.

PLANERS—
Atlas Machine Co., Pittsburg, Pa.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

PLANER TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

PLANISHED IRON—
American Sheet Steel Co., New York City.

PLATES—
American Steel & Wire Co., Chicago, Ill.
A. M. Crane & Co., Chicago, Ill.
Enterprise Boiler Co., Youngstown, O.
Illinois Steel Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
W. J. Schaefer Co., New York City.

PNEUMATIC TOOLS—
American Engineering Works, Chicago, Ill.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Link Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PRESSES—
Atlas Machine Co., Pittsburg, Pa.
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PRESSURE GAUGES—
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PULVERIZING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

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Blakeslee Mfg. Co., Du Quoin, Ill.
The Deming Co., Salem, O.
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American Steel Hoop Co., New York City.
The Atlas Car & Mfg. Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Joseph Schonthal, Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

RAILWAY SUPPLIES—
The Atlas Car & Mfg. Co., Cleveland, O.
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
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Champion Rivet Co., Cleveland, O.
Vulcanus Forging Co., Cleveland, O.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co., Youngstown, O.

RIVETERS—
R. D. Wood & Co., Philadelphia, Pa.

RIVETING HAMMERS—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

RIVETING MACHINES—
Chicago Pneumatic Tool Co., Chicago, Ill.

RIVET MACHINES—
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

ROCK CRUSHERS—
Raymond Bros. Impact Pulverizer Co., Chicago.

ROCK DRILLS—
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Rand Drill Co., Chicago, Ill.

ROLL FORGINGS—
Frankford Steel & Forging Co., Philadelphia.
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
Canton Roll & Machine Co., Canton, O.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
The United Boiler Co., Girard, O.
West Penn Foundry & Machine Co., Avonmore, Pa.

ROOFS—
American Bridge Co., New York City.
McCullough Iron Co., Wilmington, Del.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

ROPE AND CORDAGE—
Dodge Mfg. Co., Mishawaka, Ind.
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Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
Waterbury Rope Co., New York City.

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Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

SAWING AND DRILLING MACHINERY—
J. R. Vandyck, New York City, N. Y.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
A. M. Crane & Co., Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.
Joseph Schonthal, Pittsburg, Pa.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.

SCREWS—
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Chicago Screw Co., Chicago, Ill.
Upson Nutt Co., Cleveland, O.

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American Engineering Works, Chicago, Ill.
The Atlas Machine Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
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Pelton Engineering Co., Cleveland, O.
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Bethlehem Steel Co., South Bethlehem, Pa.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

SHEARING AND PUNCHING MACHINERY—
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Bethlehem Fdry & Mach. Co., S. Bethlehem, Pa.
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Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.

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Atlas Machine Co., Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON AND STEEL—
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

SHEET METAL WORK—
The W. J. Clark Co. Salem, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
The Aultman Co., Canton, O.
Avery Stamping Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM AND GAS FITTERS' TOOLS—
The Crane Co., Chicago, Ill.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM HAMMERS—
American Engineering Works, Chicago, Ill.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co. Chicago, Ill.

STEAM PACKING—
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Edw. P. Allis Co., Milwaukee, Wis.
Blakeslee Mfg. Co., Du Quoin, Ill.
The Deming Co., Salem, O.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Torbert & Peckham, Chicago, Ill.
R. D. Wood & Co., Philadelphia, Pa.

STEAM SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.
Wright Manufacturing Co., Cleveland, O.

STEAM SHOVELS AND DREDGES—
The Bucyrus, Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
The Thew Automatic Shovel Co., Lorain, O.
Torbert & Peckham, Chicago, Ill.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O

STEEL—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
A. M. Crane & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa
Otis Steel Co., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
A. M. Crane & Co., Chicago, Ill.
Jerome Keeley & Co., Philadelphia, Pa.
The Lorain Steel Co., Lorain, O.
National Steel Co., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
Bethlehem Steel Co., South Bethlehem, Pa.
Otis Steel Co., Cleveland, O.
The Sargent Co., Chicago, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
American Bridge Co., New York City.
Pittsburg Steel Construction Co., Pittsburg, Pa
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STEEL SHEETS—
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

STEEL STAMPS—
F. A. Sackmann, Cleveland, O.

STENCILS—
F. A. Sackmann, Cleveland, O.

STOCKS AND DIES—
The Crane Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TANKS—
The Aultman Co., Canton, O.
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O.
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Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
The United Boiler Co., Girard, O.

TANK CARS—
Wm. B. Pollock Co., Youngstown, O.

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

TIN AND TERNE PLATES—
American Tin Plate Company, New York City.
Champion Iron & Steel Co., Muskegon, Mich.

TIN PLATE MACHINERY—
Canton Roll & Machine Co., Canton, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.

TOOL STEEL—
American Steel & Wire Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

TORCHES—
Somers, Fitler & Clarke, Pittsburg, Pa.

TRAMWAYS—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry & Machine Co., Chicago.
Link Belt Machinery Co., Chicago, Ill.

TRANSMISSION ROPE (WIRE)—
American Steel & Wire Co., Chicago, Ill.

TROLLEY TRACKS—
The Atlas Car & Mfg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.

TROLLEY WIRES—
American Steel & Wire Co., Chicago, Ill.

TRUCKS—
The Atlas Car & Mfg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.

TUBES—
S. Fox' Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.

TUBE WELDING—
S. Fix' Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.

TURBINE WATER WHEELS—
Stilwell-Bierce & Smith Vaile Co., Dayton, O.

TURNBUCKLES—
Ceveland City Forge & Iron Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Somers, Fitler & Clarke, Pittsburg, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
C. H. Besly & Co., Chicago, Ill.
The Best Manufacturing Co., Pittsburg, Pa.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Jenkins Bros., New York City.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER COLUMNS—
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER PIPE—
Massillon Iron & Steel Co., Chicago, Ill.

WATER SOFTENING PLANTS—
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

WIRE—
American Steel & Wire Co., Chicago, Ill.
Summit Wire Co., Cuyahoga Falls, O.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Co., Columbus, O.

WIRE MACHINERY—
S. W Goodyear, Waterbury, Conn.
F. B. Shuster Co., New Haven, Conn.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
American Steel & Wire Co., Chicago, Ill
A. Leschen & Sons Rope Co., St. Louis, Mo.
Waterbury Rope Co., New York City.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

WIRE ROAP FILLING—
The Ironsides Co., Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.
Somers, Fitler & Clarke, Pittsburg, Pa.

WROUGHT PIPE—
The Crane Co., Chicago, Ill.
National Tube Co., Pittsburg, Pa.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

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*Fix Sons	—
Forsythe Pattern Works	42
Frankford Steel & Forging Co	47
Frank-Kneeland Machine Co	41
Fraser & Chalmers	39
Frick Coke Co., H. C	1
Gandy Belting Co	60
Garden City Sand Co	45
Garrett-Cromwell Engineering Co	38
Garrison Foundry Co	40
Gerlach, Peter & Co	34
Gobeille Pattern Co	42
Goodyear, S. W	37
Grasselli Chemical Co	34
Greenwald Co., I & E	29
Haines Gauge Co	2
Hall, R. C	25
Hanna & Co., M. A	43
Harrisburg Foundry & Machine Works	52
Harrison Safety Boiler Works	23
Hartford Steam Boiler Insp. & Ins. Co	32
Haws & Sons, A. J	45
Hendrick Mfg. Co., The	39
Hickman, Williams & Co	43
Hiertz & Son, Theo	2
Hillman & Son, J. H	1
Holmes & Co., F. B	44
Hooven, Owens & Rentschler Co	33
Hunt & Co., Robt. W	2
Hyde Bros. & Co	52
Illinois Steel Co	52
Ingersoll-Sergeant Drill Co	2
International Correspondence Schools	44
Iron Clad Paint Co	41
Ironsides Co	25
Jeffrey Mfg. Co	44
Jenkins Bros	31
Jones Foundry & Machine Co., W. A	1
Keeley & Co., Jerome	25
Kennedy, Julian	39
Kennedy, Walter	39
Kentucky Fire Brick Works	26
Keystone Driller Co	42
Keystone Fire Clay Co., The	44
Lake Superior Consolidated Iron Mines	43
Lamond, David	39
Laughlin & Co., Alex	39
Leschen & Sons Rope Co., A	37
Lidgerwood Mfg. Co	38
Link-Belt Machinery Co	38
Lorain Foundry Co	40
Lorain Steel Co	51
Lunkenheimer Co., The	31
Marion Steam Shovel Co	60
Massillon Iron & Steel Co	34
McKeefrey & Co	43
Meadville Malleable Iron Co	2
Meehan Boiler & Construction Co	60
Millet Core Oven Co	36
Milton Manufacturing Co	48
Monongahela Iron & Steel Co	34
National Elastic Nut Co	37
National Steel Co	48
National Tube Co	48
†Newport Sand Bank Co	—
Northampton Emery Wheel Co	32
Northern Engineering Co	38
Nuttall Co., The R. D	33
Oak Hill Fire Brick & Coal Co	26
Obermayer Co., S	28
O'Gara, King & Co	42
Oglebay, Norton & Co	43
†Ohio Sand Co	—
Otis Steel Co	25
Pelton Engineering Co	52
Perfect Lubricating Metal Co	60
Phœnix Horse Shoe Co	26
Pickands, Brown & Co	43
Pickands, Mather & Co	43
Pilling & Crane	1
Pittsburg Filter Mfg. Co	53
Pittsburg Steel Construction Co	2
Pittsburg Valve, Foundry & Construction Co	36
Pollock Co., The Wm. B	2
Pratt Chuck Co	37
Prescott Steam Pump Co	32
*Pullman, J. Wesley	43
Rand Drill Co	2
Raymond Bros. Impact Pulverizer Co	2
Reese-Hammond Fire Brick Co	44
Republic Iron & Steel Co	I-51
Riter-Conley Mfg. Co	39
*Rockwell Engineering Co	I-27
Rosenow & Co	34
Ryan, J. J. & Co	60
Sackmann, F. A	36
Scaife & Sons, Wm. B	59
Schonthal, Joseph	52
Schuylkill Iron & Steel Co	59
Scientific Manufacturing Co	39
Scioto Fire Brick Co	45
Scioto Star Fire Brick Works	45
Seaman, Sleeth Co	40
Sennett Co., Geo. B	29
‖Sharon Fire Brick Works	1
Shuster Co., F. B	35
Sloss Iron & Steel Co	47
Sloss Sheffield Steel & Iron Co	47
Smith & Co., A. F	45
Somers, Fitler & Clarke	1
Southwark Foundry & Machine Co	29
Spearman Iron Co	60
Springfield Machine Tool Co	1
Standard Chain Co	44
Stevens, F. B	60
Stilwell-Bierce & Smith-Vaile Co	I-24
Summit Wire Co	50
*Superior Charcoal Iron Co	—
*Tabor Mfg. Co	44
Tennessee Coal, Iron & Railroad Co	47
Textor, O	2
Thew Automatic Shovel Co., The	2
Tod, Stambaugh & Co	43
Tod, Wm. & Co	29
Torbert & Peckham	52-53
Totten & Hogg Iron & Steel Foundry Co	40
Trethewey & Co., Ltd., Samuel	34
Union Mining Co	25
United Boiler Co	39
United States Telephone Co	2
Upson Nut Co	1
Van Dorn & Dutton Co	33
Vandyck, J. R	28
*Vulcan Iron Works	—
Vulcan Mfg. Co	34
*Vulcanus Forging Co	—
Waterbury Farrel Foundry & Machine Co	30
Waterbury Rope Co	39
Webster, Camp & Lane Machine Co	26
Webster Fire Brick Co	1
Webster Foundry Sand Co	45
Wellman-Seaver Engineering Co	39
West Penn Foundry & Machine Co	41
Wheeling Mold & Foundry Co	60
White, Byron H	34
Wood & Co., R. D	28
Wormer Machinery Co., C. C	52
Wright Manufacturing Co	51
Wyman & Gordon	59